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"AND THE NEED OF A WORLD OF MEN FOR ME." — BROWNING

INDUSTRY AND TRADE

HISTORICAL AND DESCRIPTIVE ACCOUNT OF THEIR DEVELOPMENT IN THE UNITED STATES

BY

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PREFACE

The aim of this book is to present a simple but adequate account of the development and present status of this country's industrial and commercial life. Representative industries are treated in the several chapters, and considerable attention is given to agencies and methods of distribution. But the dominant purpose of the authors has been to afford a perspective of our workaday life as a living and developing whole. It is hoped that the student may carry away from these pages the conception, not of a series of unrelated methods of earning a living, but rather of a working together of us all into what we may well call the nation's life.

It has now been several years since the Great War ended. During that stupendous crisis, industry and trade were not normal. The whole economic organization was forced into an adjustment determined by the dominant issue. In the several years since the cessation of hostilities our industrial and commercial activities have not entirely settled down to a normal condition. The war had a marked effect in shaping the future progress and destiny of the United States as well as of other nations. We cannot tell, as yet, just what the ultimate outcome will be. We are in a transitional period, and while we are in it nobody can be as sure of the probable future course of events as he can after a long period of peace.

In the successive chapters of this book the reader will find set forth the essential features of our industrial and commercial life. Not only is the present-day situation portrayed, but also a historical background has been added so that the student may

appreciate better than he otherwise could the small beginnings from which our industrial and commercial activities have developed. The dislocations resulting from the war are at times indicated, and the developments and adjustments which have been effected since the close of the conflict are set forth.

In this book we have not tried to set down minutely accurate statistics; we have used round numbers that can be more easily retained in memory, but we regard them as entirely representative of essential conditions. They represent such fidelity to actual circumstances as is demanded for a perspective view.

The authors have drawn freely upon the standard treatises in the various lines touched upon in the text, such as conservation, immigration, transportation, and industry and trade in general, and much use has been made of government publications, especially those of the Census Bureau. Our obligation to such sources is a general one scarcely admitting of specification.

THE AUTHORS

New Haven, Connecticut

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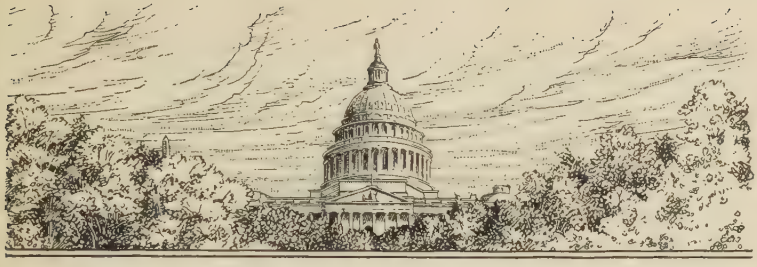


INDUSTRY AND TRADE

INTRODUCTION

It will not be long before every school student is "out in the world." That is what he or she is getting ready for during the school years. There is a living to make and a life to lead, and all must get into the game. But it is poor business jumping into a game whose conditions and rules we do not know. We don't want to make a hit and then run to third instead of first, or we shall pretty soon be sitting on the bench, watching better-informed people play.

The game this book deals with — the game of labor and industry — is one we cannot stay out of unless we want to be professional loafers or tramps. We want to take part in winning prosperity for our country, and for ourselves along with it. No country is truly prosperous if its people are afraid of work. The industries of a country are the basis of its well-being. Yet mere work or industry is not enough; the labors of us all must be intelligent if they are to set us high among the nations and peoples. And that means that we must be thoroughly informed about what we have to do with, here in America, and how we can best put it to use. We shall win out as a people, and also as individuals, in proportion as we possess wide and exact knowledge.

We want to know what is being done in the industrial and business world so that we can better decide where to put in our efforts

to best advantage. And not that alone — we also need to know what has been done in the past; for that will show us how things have come to be what they are, and will give us hints as to how they can be improved still more. Knowing about the history of our industries furnishes us with a sort of map or chart of our country's life from which we can the more readily lay out our future course.

Successful peoples have always had to learn what they had to do with and how best to use it. The young Indian brave had to know what game there was, where to find it, and how to lay hand on it, or he failed in his career as a hunter. He must know where the best flint was to be found for his arrowheads, where he could most easily ford the rivers, how to dry and preserve skins and meat, and many another practical thing. He must know the rules of warfare and the chase, so that he might be a help and not a hindrance to his fellows. If he learned all this — and it took effort to do so — he became a respected and admired member of his tribe. He made himself a career.

It is the same with us. We must know where the iron and copper are and how to get them out; where and how to build roads and railways; how to mill and market wheat and corn; how to build ships and sail them. We must know the rules of industry and business and how to be a help and not a hindrance to our fellow citizens. If we learn all this — and it will take study to do that — we shall become respected and solid citizens of the Republic. We shall each make a career. We shall be able to pull our own weight, and more, in the boat. There can be no greater satisfaction in life than that.

To bear an intelligent part in the destiny of the nation, as well as to make a personal success for ourselves, we must know our land and its people. What sort of a land have we, and what sort of a population? Then, what can we get out of the land? Shall we try to raise bananas in Maine, or fish for cod in the Mississippi, or mine for coal in Florida? We need to know our best resources and where they are, and not be easy marks for confidence-men or robber-nations. Cotton and coal, meat and

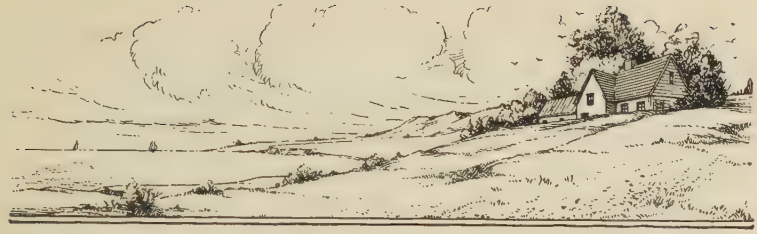
wheat — these are not dull, uninteresting things. They are what we live by, as a nation, and win success with. It is interesting to watch a big train sweep by; but it is more fascinating to think of the endless stream of commodities which it helps to move and of the trade which takes things from the hands of men who never heard of us (and who live, perhaps, halfway around the globe) and delivers them at our doors.

Understanding the workings of industry and commerce helps in the game of living — that is clear enough. But it does more. It gives one a wider vision of things. You look at all the busy life of your country and of the world, and you see it as a great panorama of human beings and nations working together to make human life a fuller and happier thing. This is an interesting thought; and that sort of thought, and a widened vision, make one's own life more full and satisfying. The happiest man, said one wise writer, is the man with the greatest number of interesting thoughts.

It is well worth while to know things, and particularly worth while, in this age, to know the fundamental facts about our nation's life. Some of these we are about to recount in the pages that follow; and we shall begin with the most fundamental, by considering the land and the people that go under the name America.

MAP OF THE WORLD SHOWING THE UNITED STATES AND COLONIES

The names of our possessions (other than Alaska) are in heavy black type, as **Porto Rico**



PART I. BASIC FACTORS IN OUR INDUSTRY: LAND AND PEOPLE

CHAPTER I

PRODUCTIVE AREAS AND PHYSICAL FACTORS AFFECTING PRODUCTION

Land. The basis of all life on earth is land. Plants, animals, and human beings alike live on the land and from it. Each of them requires a certain space upon which to live, for they all are subject to the law of gravitation, which draws them down to the earth whether they will or not. And all living beings require, in order that they shall continue to live, certain chemical elements which must be derived from the soil. Without plenty of land-area there cannot be an abundance of plant life, animal life, or human life. In particular, there can be no great and populous nation unless that nation possesses wide areas of land.

Land-wealth of the United States. The American nation has been favored in this respect. There has always been more than enough land for the use of its population. As the nation has grown from its small beginnings in colonial times, wide areas have been added to its holdings, and the population has always had plenty of space over which to spread and within which to develop its life. In fact, within recent times we have acquired areas in parts of the world quite distant from us, so that there is a good deal of our territory which does not belong to " The United

States Proper." Such regions are Alaska, the Philippines, Porto Rico, and the Virgin Islands.

Area of The United States Proper. In this book we are to give our attention almost wholly to the United States proper and its industrial activities; that is, to that portion of our territory which lies, east and west, between the Atlantic and the Pacific, and between Canada, on the north, and Mexico and the Gulf of Mexico, on the south. This area includes about three million square miles — a figure which may mean more to us if we recall that each of these square miles includes six hundred and forty acres. This is an immense area; the United States is nearly as large as the whole continent of Europe. The distances in this country are vast: that from the Atlantic to the Pacific, across the country, is about twenty-five hundred miles, or nearly as far as the direct steamship route across the Atlantic; while the distance between our northern and southern boundaries is about twelve hundred miles It is evident that we are not likely to suffer, for some time to come, from lack of land.

General location of our land. Mere quantity of land does not count for so much by itself; the land must be so located as to be of advantage to the people occupying it. The United States possesses great advantages in being situated in the middle of the North American continent, neither too far north nor too far south. This means that its climate is favorable, as we shall see, for the development of a vigorous civilization based on a strong industrial life. In fact, it has been very fortunate for us that we were located north, rather than south, of the equator; for human civilization has been developed in the north latitudes rather than in the south, so that our neighboring nations have been those of Europe and Asia rather than those of Africa and Australia. There is much more land in the Northern Hemisphere than in the Southern, and so we have been surrounded by populated land-areas rather than by waste regions of salt water. Also, as civilization has developed, it has been fortunate for us that we have bordered upon the narrower oceans of the Northern Hemisphere, for the

water has become a means of connection and communication rather than a barrier between nations.

Quality of the land. Land may be large in amount and not so badly located, but if its quality is poor it is not of much use. The Desert of Sahara is large enough, and for many centuries it has been near lands of a high civilization, but the quality of its land is such that it has never supported more than a very scanty population. It is also fortunate for a country if its land is not all of the same sort. Our country is not noted for uniformity and monotony of physical features; its land is of many types, yielding a corresponding variety of natural products, and thus supporting a great many different kinds of industry. The physical features of the United States have, from the very beginning, had a marked influence in determining the occupations and activities of the people. Different areas of our land have had contrasting qualities, due to differences in climate, weather, altitude, kinds of soil, and other factors, which determine what the quality of the land shall be. But the quality of the land determines its productive capacities, and the productive capacities determine the industries. It is these industries which we are chiefly interested in studying, and so it is necessary for us to understand beforehand the nature of our productive areas, in their broad general outlines.

Quality of men. No matter how excellent the location and quality of the land, it is useless without the application of labor upon it. This country was of no use to the rest of the world, no matter how extended and fertile its area, until a population had occupied it which could make use of the country's resources. But the quality of any population is largely dependent upon certain physical features, such as climate, the influence of which upon the life of human beings determines, in large part, what they are and what they can do. In viewing the physical factors affecting production, to which we now come, it is necessary to consider their influence not only upon the land and its crops but upon the human beings who are to develop the land and raise products from it.

Physical Factors influencing Production

Before we can enter upon the description of our natural areas we must consider the general effects of certain physical factors which really determine the quality of land and men and the possibilities of production. The more special effects of these factors will be seen when we come to take up the several special industries. Some of these factors which affect production have already been named; we shall consider climate, latitude, altitude, nearness to the sea, winds, ocean currents, topography, rainfall, and soil.

Climate. The importance of climate as a controlling factor of a country's destiny can hardly be overestimated. It exercises a far-reaching influence upon plant and animal life and upon that of human beings. Climate is really a combination of the elements of heat and cold, moisture and dryness. The plant life of the tropics forms a striking contrast with that of the arctic regions; and, even within the same latitude, the vegetation of arid regions is very unlike that of humid regions. Again, the animal life of the tropics or of arid regions may be contrasted with that of the polar areas or of the damp forests. Human life also, in these several regions, shows great differences, which correspond to the differences in plant and animal life.

Factors of climate. Probably no other physical factor has so great an influence in man's activities in getting a living, that is, in his industrial activity, as has climate. There are a number of factors which unite to determine the character of climate, such as latitude, altitude, nearness to the sea, winds, ocean currents, and general topography. All of these combine to affect temperature and rainfall; that is, degree of heat and degree of moisture.

Latitude. The amount of heat received from the sun at any given place depends chiefly upon latitude. An excess of cold or of heat affects normal human effort. It is in the temperate zones that labor can be carried on most steadily and with the greatest success. Here physical toil can go on the whole day, either within doors or without, for practically the whole year. In the colder

regions very strenuous effort results in little more than the mere maintenance of life; in the hot regions human energy is weakened and there is a strong desire to avoid work; but in the temperate zones steady effort is not only possible but good for one, and when it has been put forth its reward is generous. It is, therefore, a very important condition of the industrial life of the United States that the whole country is within the temperate zone and that only a small portion of it is even subtropical. It will be seen that the most vigorous industrial life of the country is in those portions which lie north of even this subtropical belt.

Altitude. Elevation above sea level is a factor which has a marked influence upon temperature. As we ascend from the sea the cold gradually increases, so that even at the equator the mountain tops may be covered with snow; the side of a high mountain may show belts of plant life all the way from equatorial vegetation at the base to arctic plants near the summit. Hence we see that in the matter of temperature a high altitude is equivalent to a high latitude.

Nearness to the sea. Land bordering on the sea takes its temperature to a large degree from that of the water. The water both receives and radiates heat more slowly than does the land; and so nearness to the sea levels down the extremes of temperature and makes the climate of the shore more even than that of inland areas. The weather-changes in a single day in a region with a continental climate are often greater than those of an entire year in a region with a tropical, maritime climate.

Winds. However, since winds are very effective in carrying heat and cold, a continental climate may, by reason of prevailing winds, be found near the coasts of continents, and vice versa. The winds also carry moisture over the earth, and thus are, in another way, efficient in determining climate. For example, the trade winds and the monsoons are specialists in the conveying of moisture; the very life of India depends upon the monsoons. Winds are, therefore, important factors in determining where man shall live and what he shall do.

Ocean currents. It may be said, first, that winds help determine the course of ocean currents. These currents greatly modify the climate of certain lands through their effect upon the temperature of the air above them. For example, the Gulf Stream carries so large a body of relatively warm water into the North Atlantic that it is effective in raising the temperature of the winds which blow over it. Hence the climate of western Europe is milder and more humid than it would otherwise be. On the other hand, the cold Labrador current keeps the eastern coast of North America cooler — a contrast which becomes more forcible when the climate of England is compared with that of Labrador, both countries lying in about the same latitude.

Topography and aspect. Topography has an influence upon both temperature and rainfall. In the valleys of mountains, for example, important differences in temperature occur within short distances. The fact, also, that there are no mountains to break the wind allows the entrance of cold winds from the north upon the central plains of this country. Aspect means the slope of the land in respect to the sun — whether the slope is towards the sun or away from it. In general, in the Northern Hemisphere, regions having a southern aspect or exposure are much warmer than regions of the same altitude and latitude that slope toward the north. Wheat grows on the southern slopes of the Alps at twice the altitude reached by it on the northern slopes. In the United States a favorable location for gardens and orchards is on hills with a southern aspect; the farmers say that crops in such places "get more sun." In the Southern Hemisphere the reverse is true.

Rainfall. The annual rainfall upon the earth varies greatly for different regions; almost all places have some rain or snow at some time during the year, but the total annual fall of rain varies from less than one inch to more than four hundred inches. The amount of rainfall in a region affects the character and quantity of plant life; this determines the character and quantity of animal life, including that of human beings; and the character of the plant and animal life determines largely what man can be and do in the locality.

Rainfall and agriculture. A region with less than ten inches of rainfall annually would be unfavorable for human life; and an average of twenty inches is desirable, if not absolutely necessary, for agriculture. But it should always be remembered that the time when the rain comes is more important than the yearly amount; over twenty inches would not be enough if it fell at the wrong time of the year, say, in the winter, while less than twenty inches would suffice if it all came during the growing season for crops. A fine corn crop has been reported from Kansas when the rainfall was only eight inches for the year; but in this case the rain came mainly in the spring and early summer. Large areas of the United States have a fair amount of rainfall, which, fortunately, comes usually during the growing season and meets the needs of our crops.

Irrigation. Men have learned to bring water to places where it is not to be found in the ordinary course of nature; irrigation is now making it possible to cultivate with profit areas deficient in rainfall.

Soil. By soil we mean the outer covering of the earth, which rests upon the solid rock as a sort of mantle. Sometimes it is only a few inches thick, sometimes several hundred feet. It is formed from the rock by the action of physical and chemical forces. Since soil is, directly or indirectly, the ultimate source of food, shelter, and clothing, its power to yield these necessary articles must finally determine the quantity and quality of human life. Where soil is poor, there is a small population, and vice versa. The cultivation of the soil is the basis of civilization, and from it come the raw products of industry.

Plant foods. In order that plants may grow, there must be present in the soil certain chemical elements known as essential plant foods; if these are lacking, plant life will not flourish, unless they are introduced in the form of fertilizers. There are nine essential plant foods: carbon, hydrogen, oxygen, nitrogen, lime, magnesia, potash, phosphorus, and sulphur. There are elements other than these in soils, but they are not absolutely necessary to

support plant life. A productive soil must have water in it; this appears as a minute film surrounding the soil particles and holding in solution the various elements essential for the support of plant life. Soils also contain air, without which they are barren; this air supply can, of course, be increased by the loosening of the soil. "A soil," says Van Hise, "perfect in chemical and physical condition, containing neither water nor air, could not by any possibility sustain life."

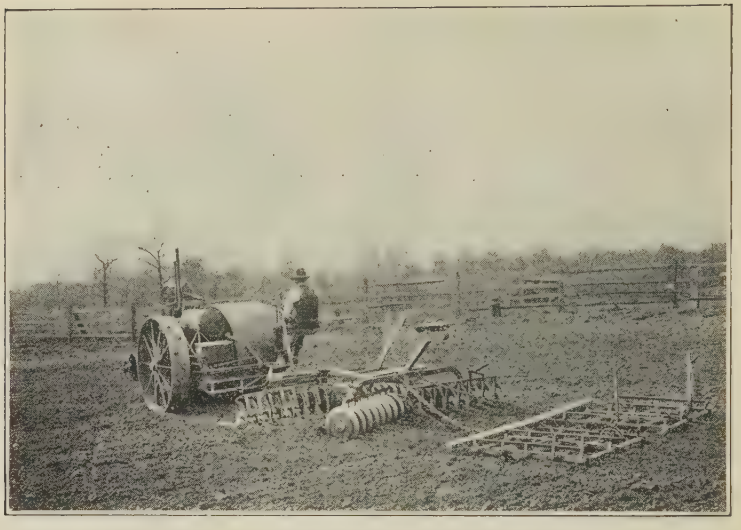
LEADING CITIES ALONG THE "FALL LINE"

Productivity of soil. In a country as large as the United States there are to be found many different kinds of soil, which vary greatly in their suitability for the different crops raised by man. As a general rule, a coarse gravelly soil is rather barren; a limestone soil, a clayey soil (if not too fine), or a glacial soil is productive — in the United States some of the best food-producing areas have the advantage of a glacial soil.

Soil and climate. Soil and climate together form a basic combination in determining the variety and abundance of plant life, and so of the animal life which is dependent upon it. But man's responsibility in the use of these two factors is very diverse. Climate is a thing which man cannot change; while it is within his power to make the soil poor by unscientific use of it, or, on the other hand, to make it better by careful use. He may therefore rail at the weather or the climate all he pleases and defy anyone to lay the fault at his door; but if he foolishly exhausts his land, plainly he has only himself to blame.

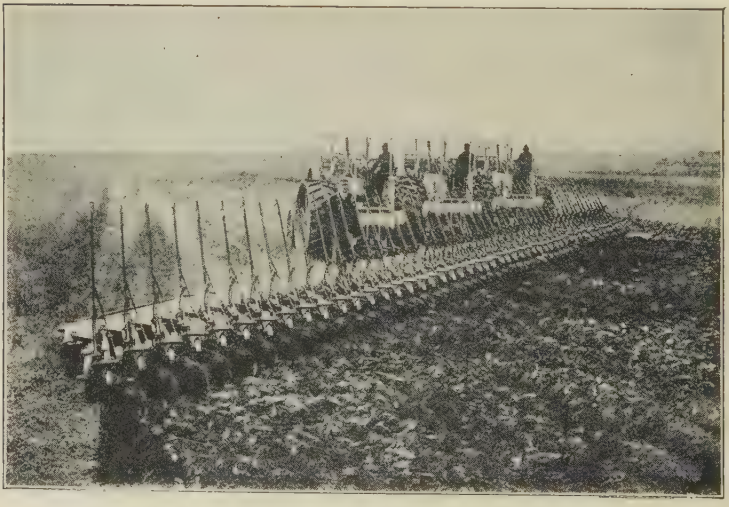
TYPICAL EARLY MANUFACTURING PLANT

A MODERN MANUFACTORY — ROLLING MILLS



HARROWING A FIELD IN PREPARATION FOR PLANTING

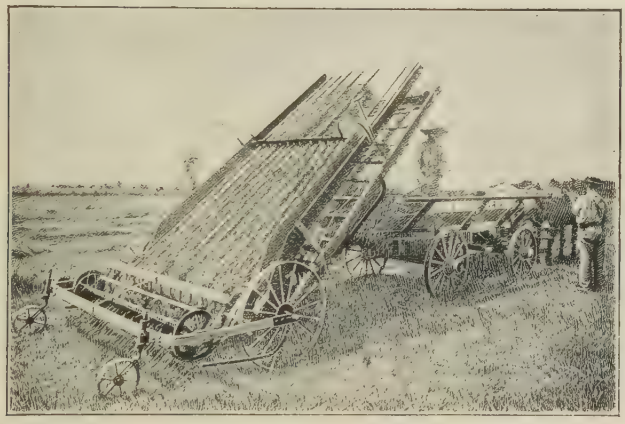
Courtesy of United States Department of Agriculture



FIFTY PLOWS DRAWN BY THREE TRACTORS

Natural Productive Areas of the United States

Roughly speaking, the one-hundredth meridian divides the United States into two nearly equal but sharply contrasting divisions. From the standpoint of elevation and rainfall the eastern half is low and humid and the western half high and dry. This is the broadest division which we can make. There is another, along Mason and Dixon's line, which divides the South



A MODERN HAY LOADER

and North; but it has not been so important in the development of our industries. Within these two eastern and western divisions are other less extensive areas, or natural regions. The geographers divide and group these lesser regions in several ways, but for our purposes, because we are to study the *industries* of the country, the following general division of physical areas in the United States may be made: (1) the Atlantic Coastal Plain; (2) the Appalachian Mountains; (3) the Central Lowlands; (4) the Western High Plains; (5) the Rocky Mountains; (6) the Western Plateaus; (7) the Pacific Slope.

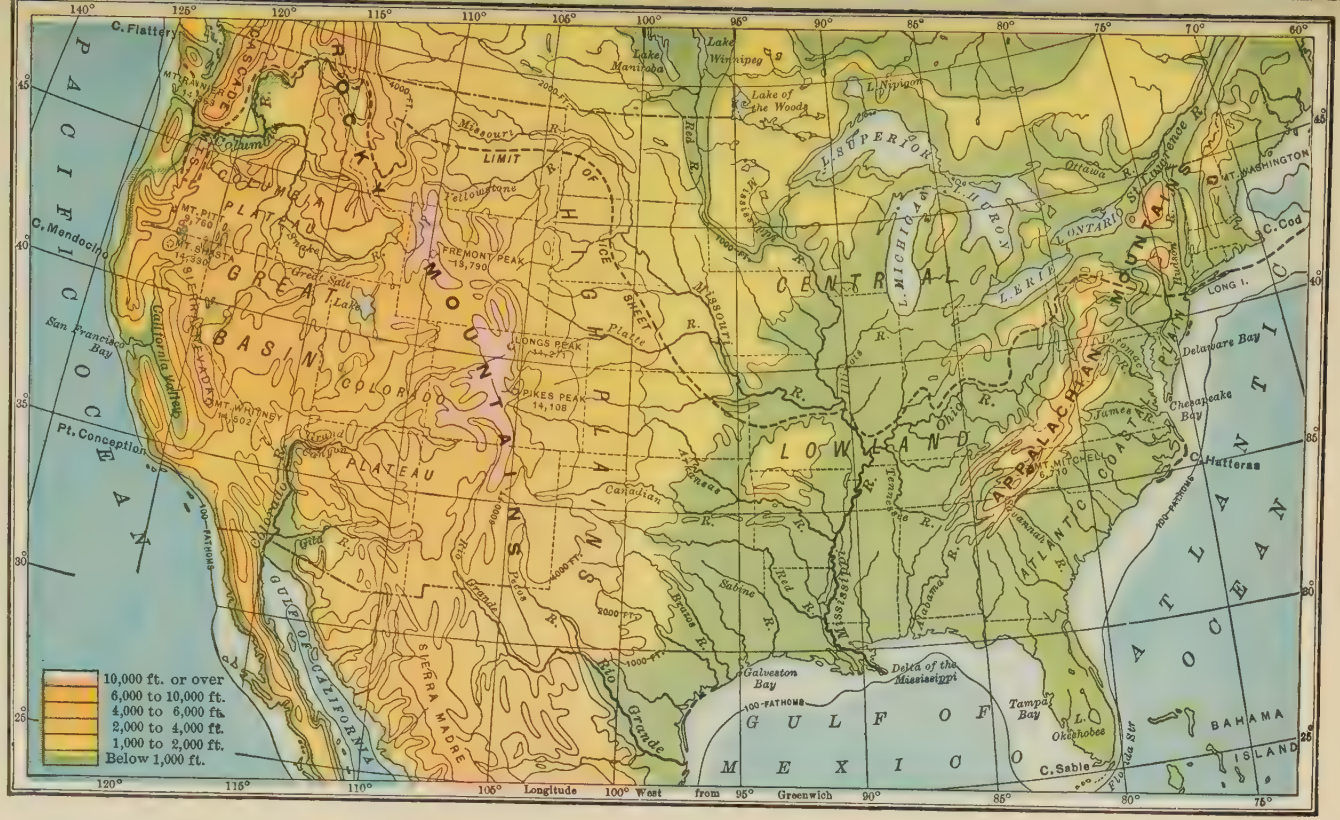
Atlantic Coastal Plain. This plain is bordered by a fringe of sand reefs, used in the North for pleasure resorts, and on the

Carolina coast for growing sea-island cotton. The soil of the plain is arranged roughly in belts; there are stretches of rich agricultural land bordering on others which are somewhat sandy but covered with useful trees. The inner edge of the coastal plain furnishes valuable soil, and here are the choice agricultural lands of Pennsylvania, Virginia, and the Carolinas. Two rows of cities mark the boundaries of this plain: the outer row, including Norfolk, Wilmington, Charleston, and Savannah, on the seacoast; the inner row marking the so-called "fall line" (p. 12). This is a

SHEEP GRAZING ON THE WESTERN HIGH PLAINS

line of waterfalls, furnishing excellent power, where the streams descend to the coastal plain. The region is well supplied with rain, which reaches its maximum in late summer.

Appalachian Mountains. These include the eastern highlands from the St. Lawrence to Georgia; they are not an agricultural district, but to the north they form a center of manufacturing in New England, and, farther south, one of coal mining in Pennsylvania, West Virginia, Tennessee, and Alabama. Except in the Cumberland, Shenandoah, and Tennessee valleys, mining and lumbering, rather than agriculture, are the industries of the Appalachian region. Within this section lie centers of the iron and steel industry, such as Pittsburgh and Birmingham. The maximum rainfall occurs in winter and spring.



PHYSIOGRAPHIC REGIONS OF THE UNITED STATES

Central Lowlands. This region is flat, and even the Great Lakes are portions of a gently sloping plain. The soil includes the glacial deposits of Michigan, Ohio, Illinois, and Minnesota, and the alluvial plain of the Mississippi. Here is found a variety of fertile lands matched in but few parts of the world. This central section of the country, between the Appalachians and the one-hundredth meridian, is a great agricultural section, and is devoted

TAKING ORE FROM A MINE IN DUMP CARS

to the raising of wheat, corn, and cotton. The annual rainfall is from thirty to fifty inches, and it comes at times when the moisture is most favorable for the needs of crops; it is very regular on the Gulf coast and shows a spring and fall maximum along the Lakes.

Western High Plains. These form a rather continuous plateau from Canada to Mexico, cut here and there into sections by streams from the Rocky Mountains. Owing to the deficient

rainfall, agriculture has been only partially successful in this region, but within it are included the choicest grazing lands of the United States.

Rocky Mountains. These mountains extend entirely across the country and form the watershed between the Atlantic and Pacific oceans. Some of the valleys of this region are good for

AN OREGON APPLE ORCHARD

agriculture, especially fruit-growing; but since level stretches of agricultural land are rare and the rainfall scanty, the chief industry is mining.

Western Plateaus. These lie between the Rockies and the Sierra Nevada. This region is arid. The population is sparse; it is concentrated on oases and in narrow valleys where, with the aid of irrigation, some agriculture is possible. The rainfall varies from five to twenty-four inches, but is generally about ten to fifteen inches. Naturally the chief industry of the region is mining.

Pacific Slope. The Cascade Range and the Sierra Nevada border the plateau region and show a well-watered westward side with a good growth of timber. There are in this region two valleys, one extending south from Seattle and Vancouver and the other occupying central California. The northern valley has fifty to sixty inches of rain, which may be expected any time from October to May; the southern valley has less than half as much rain. The lowlands in the southern part of California are practically rainless. The population is engaged in two occupations: mining and the cultivation of these two valleys. The agricultural products are wheat, fruit, and wine.

Summary. These are the main physical regions of our country. Their character determines the nature of their population and of the industries which this population develops. Their natural resources, in general, are a great national asset, and certain of them, such as coal and iron, are essential in industry. One of the leading reasons why the United States has developed into such an important industrial nation is because of the wealth and extent of its natural resources — of which we shall now make a survey.

CHAPTER II

NATURAL RESOURCES

Products of Land

Are natural resources unlimited? Natural resources are products of nature useful to man. Some of them, such as air and sunlight, seem to be unlimited in quantity. If they were actually unlimited in quantity, they could have no price or money value; in proportion as they are rare, their price is high. Abundance or scarcity of natural resources always means abundance or scarcity in relation to population. In a thinly settled country, air, water, and even land are practically unlimited in quantity and have little or no money value; they are regarded as free gifts of nature. But in a crowded city block, land is very valuable, water has to be bought, and good air and sunlight have to be paid for in the form of a higher rent.

Wastefulness. We generally regard these resources as unlimited and free until we are made to see that they are not so. We have regarded fertility of the soil as a free gift, and have neglected to preserve it by restoring to the earth the plant foods we have used out of it; we have not spared our trees, supposing there would always be plenty of them because once there were forests which the population of that time could not possibly have exhausted; we have polluted our streams. Now, as our population has increased, we are beginning to see that we must conserve our natural resources if we are going to have them; and we have undertaken

to conserve, first of all, those resources which we can see to be not unlimited in amount, and which will be unequal to the present and future needs of the nation.

Conservation. This is the nation-wide movement for conservation of natural resources. But when we speak of such conservation we do not mean that the natural resources which we see are limited in quantity shall not be touched — shall remain undeveloped; we mean that they shall be so wisely used that we shall have what we need without lessening the stock of resources for succeeding generations. This can be done by preventing waste, by keeping the soil fertile, by planting trees, and by other enlightened methods.

Utilization of natural resources. No matter where man lives, or how low or high his degree of civilization, he uses the natural resources of the earth to supply his three great needs: food, clothing, and shelter. Civilized man has made use of dozens of natural resources which the savage formerly inhabiting a region left untouched. The Indians had a constant need of fuel, and when the local supply of wood gave out they moved on to a place where there was more; they thought, in fact, that the reason for the coming of the white man was that he was in search of wood. But to-day the people of Pennsylvania, for example, who occupy the former Delaware Indian tract, have a choice of wood, hard coal, soft coal, coke, petroleum, natural gas, manufactured gas, and electricity.

Their mere presence not enough. Very likely there are resources in nature of which we have not availed ourselves any more than did the Indians in the case of natural gas. The mere presence of the resources is not the point; the knowledge, industry, and energy of man are needed if anything worth while is to be done with them. It is true enough that "no amount of human forethought and energy will give a country beds of coal and iron"; but it is equally true that those beds might as well not be there if the population is too ignorant and slothful to make use of them. What the presence of natural resources does is to suggest and direct the lines of industrial development. They do not make

a people rich — what they do is to make an industrious people richer. The winning combination is where varied and abundant natural resources are available to an alert and industrious people.

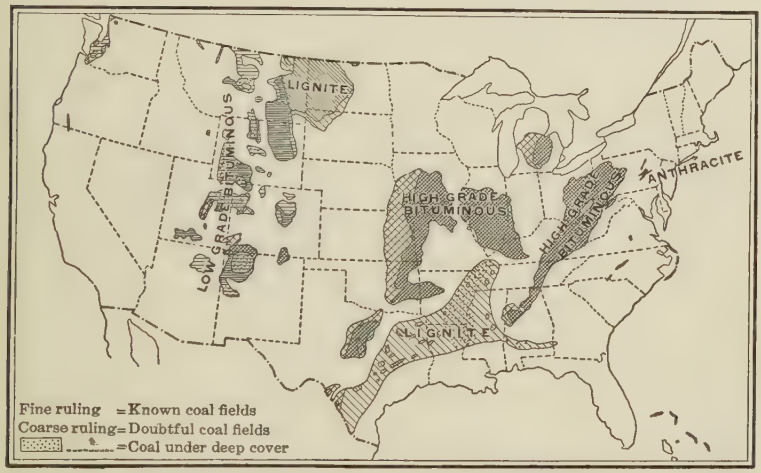
Basis of our material progress. Throughout the course of its national development the United States has made great material progress in all lines of industry. The causes of this success are the possession of the best and largest part of a rich continent, with abundant and fertile land, a healthful and invigorating climate, excellent mineral supplies, a topography permitting of easy communication, and other advantages which will be recounted as we go on. These may be considered, if we wish to use poetical language, to be "gifts of nature."

Inventory of our resources. In this country, up to recent years, we proceeded on the comfortable theory that natural resources were vast and inexhaustible; we did not even count them up and estimate their quantity. But during the latter years of the last century it became apparent that they were not inexhaustible — in fact, that some of them had been pretty well used up, not to say squandered and wasted. In 1908 a national commission was appointed to take an inventory of our natural resources — the first systematic survey of the sort which we ever made — and its report was transmitted to the President the next year. It showed, among other things, what these natural resources, along many lines, had been before they were used at all; what part of them had been used up already; and what the prospect was as to the future. In general, it clearly revealed that this continent had been very copiously endowed by nature with nearly all the important resources which go to make a nation rich and prosperous. This report is a large and detailed affair; what we need here is a much briefer and simpler inventory of those natural national resources which form the foundation of American industrial and commercial life.

Mineral resources. The mineral resources of the United States are much superior to those of any other nation. The present annual value of our mineral products far exceeds that shown by

the output of our nearest rivals. Our advantage lies in the fact that we have very copious sources for practically all the minerals that are basic in industrial development; of the minerals important in industry we produce all but platinum, tin, and nickel. In the matter of minerals we are all but independent of the rest of the world.

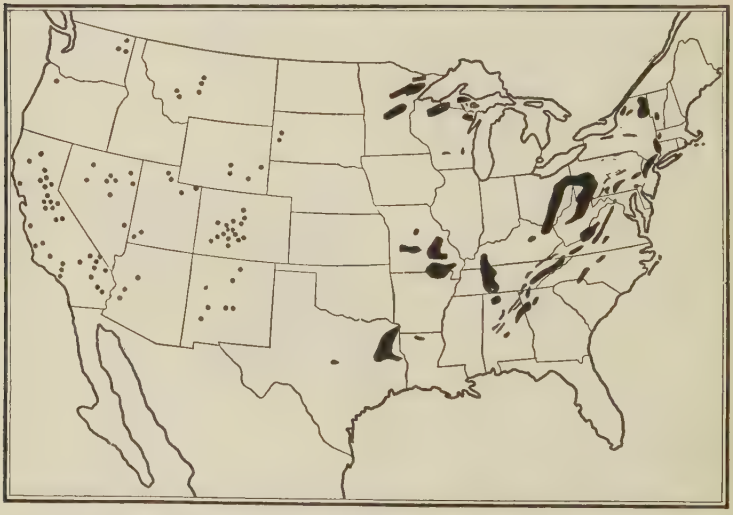
Coal. Countries with an abundance of coal and iron enjoy, in this age of the world, a surpassing advantage; it has been said



COAL AREAS OF THE UNITED STATES

that they are more than likely to be the ruling nations. Iron is one of our commonest metals; and our coal deposits outrank, both in quantity and quality, those of any other country in the world. As it is very difficult to determine the extent of mineral deposits, we have to rely upon the estimates of those best qualified to judge, when it comes to the question as to how much coal we have. Some have said that our coal deposits exceed those of all other countries combined; and one expert believes even that they represent from sixty to seventy per cent of all the coal deposits yet discovered in the world. It has been figured out that there are

about five hundred thousand square miles of coal area in this country — an area equal to about one thirteenth of the whole surface of the United States. And these coal fields are well situated; it is understood that coal is a bulky and heavy article as compared with its price and that long hauls of coal are a handicap on industry, so that it is a great advantage to manufacturers to have the coal fields widely scattered over the country instead of



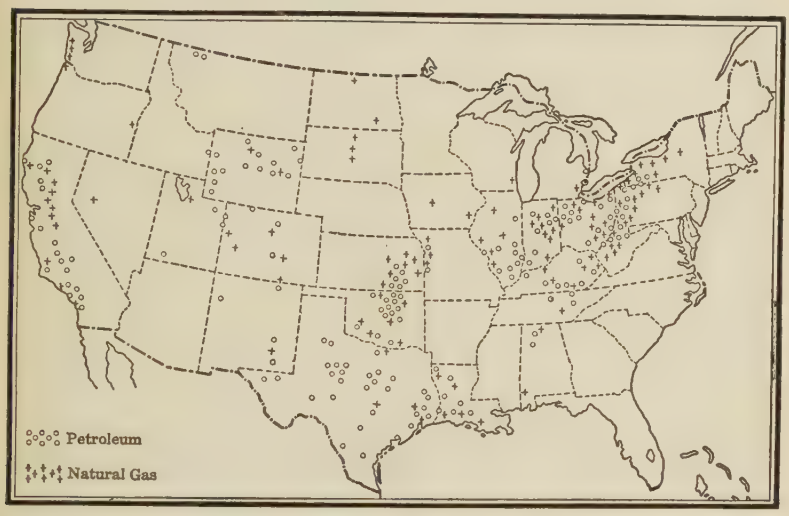
IRON ORE DEPOSITS OF THE UNITED STATES

After Harder

being concentrated in a few places. It is particularly fortunate if coal deposits are located not very far from iron deposits. But now, if we place one point of a compass on each coal area in this country and sweep a circle with a radius of five hundred miles, practically every part of the country will be included within a circle. This represents graphically the advantages available to American manufacture.

Iron. Just as coal is the most important nonmetal, so iron is by far the most important metal. Industry of the present day

is built on iron; there is scarcely an economic activity of any sort that does not require it. We need not recall the superior physical qualities of this metal which make it indispensable to civilization. It is cheap, because it is common and is easily reduced to the metallic state; but it is even cheaper, naturally, where it is most abundant and where it is near coal deposits. Iron is found in nearly every state in the Union, and at the present time is



PETROLEUM AND NATURAL-GAS FIELDS OF THE UNITED STATES

mined for blast-furnace use in three fifths of our states. This country leads all others in the annual production of iron; but, in spite of the wide development of our resources along this line, only a small fraction of the known deposits has been touched.

Petroleum. The known areas of petroleum fields total, for this country, about eight thousand four hundred and fifty square miles. In spite of the rapid and accelerated production since the fields were first tapped, in 1859, it has been estimated that there still remain to be taken from the ground from eight to ten times as much oil as has been extracted up to date.

Natural gas. Natural gas, says an expert, is "the most perfect form of fuel which nature has furnished us"; it is of higher efficiency than the so-called "producer" gas, because it is practically free from nitrogen. This country leads the world in the extent of natural-gas fields, having a combined area of about ten thousand square miles. The fields are scattered widely over the country. This natural-gas resource affords, perhaps, the worst example of reckless waste by a careless people: high-pressure wells have not been capped; other wells have been set on fire and allowed to burn indefinitely; in getting the petroleum, with which the gas is associated, the gas has been allowed to escape freely into the air, with no attempt to save it; and there has been not a little waste in transporting it through leaky pipes.

Other minerals. There are numerous other mineral resources which are important in American industrial life and which have left a mark upon the industrial history of the country. One of the most useful of these is copper, in the production of which we have for a number of years surpassed other nations. Experts tell us that it is impossible to estimate our copper deposits with much accuracy; and the same is true of other of our mineral resources, such as gold, silver, lead, and zinc. With respect to all these minerals we are important producers, and our output has been fast increasing; at the same time we have developed, on the side of technical process, the means for handling with profit lower and lower grades of ore. Our resources in aluminum are likely, as time goes on, to become the basis of an important industry; they are really illimitable, for the entire crust of the earth contains, on the average, about eight per cent of aluminum. Further, this country is well supplied with building stone and other structural materials, such as clays, slate, and cement; and there are important deposits of phosphates and other mineral fertilizers, which, because of the exhaustion of the soil over large areas of the country, are coming increasingly into demand.

This preliminary survey of mineral resources will serve as a background for our treatment of the mineral industries, presently to come. We now turn to the natural resources in living things, with which our country is endowed.

Forests. The native forests were not the product of man's labor or foresight. There are, of course, young forests that have been planted and raised by human effort, just as there are rubber plantations or herds of horses as distinguished from "wild" rubber trees or wild horses; but all of the forests which have been used in the United States hitherto were natural forests and so belong among the natural resources. Our original forests surpassed, both in extent and value, those of any other civilized nation; and they constituted a great advantage in the competition of peoples. No other element in man's environment has been more extensively utilized by him, or has entered more intimately into his life economy, than the tree. Food, clothing, and shelter have all been derived from the forest; so have materials for fuel and lighting, and for the building of edifices of all kinds, of ships, and of other useful structures. This may be the iron and steel age, but, even for building, wood is not yet dispensable.

Forests of the United States. The original forests of the United States have been classified by the National Forest Service into five main divisions, which comprise a vast extent of woodland overgrown by the most useful staple varieties of trees available for general industrial and commercial development.

The Northern Forest reached across the northern part of the country, from the Atlantic to, and including, Minnesota, and comprised New England (except Connecticut and Rhode Island), the larger part of New York and Pennsylvania, an extension from Pennsylvania along the Appalachian Ridge to northern Georgia, and more than half of Michigan, Wisconsin, and Minnesota. Originally, it is estimated, this forest covered some one hundred and fifty million acres, and was composed of white and red pine, spruce, hemlock, cedar, balsam, fir, birch, black cherry, and other hard woods.

The Southern Forest stretched along the coast from southern New Jersey, south and west, including much of Delaware, Maryland, Virginia, the Carolinas, Georgia, Alabama, Mississippi, Texas, some of Arkansas, Oklahoma, and Missouri, and all of Florida and Louisiana. Here were, originally, about two hundred and twenty million acres; and the leading wood was yellow pine, although there were great quantities of cypress, magnolia, and oak.

The Central Forest is between the two above-mentioned areas and shades gradually into them. It was once a great hardwood growth, covering some two hundred and eighty million acres and containing walnut, maple, oak, elm, and ash in abundance.

The Rocky Mountain Forest covered, originally, about one hundred and ten million acres. Yellow pine was the leading wood, though other soft varieties occurred in abundance.

The Pacific Forest embraced the timbered areas of California, Oregon, and Washington. Here, originally, about ninety million acres were covered with redwood, yellow pine, Douglas fir, and other similar trees; and here were, and still are, the giant trees of which we see pictures in the magazines.

Present condition of our forests. This is a description of our country's forests as they once were, rather than as they now are. We have been using up our forests faster than they can grow, so that there are still standing perhaps less than two thirds of the total original growth; also we have used up the best wood, so that probably not more than half of the salable timber which we originally had still remains. But we have somewhat awakened to the folly of our course and have learned from the Europeans, whose original forests began to give out a long time ago, how to use more economically what we have and how to reforest the areas which have been cut. The profession of forester is becoming quite important among us, whereas years ago no one ever heard of such a vocation.

Water power. Water itself is a necessity to life — it is really more than a resource. The human body is more than half water, and its fluid constituents must be regularly restored. Without it

FOREST AREAS OF THE UNITED STATES

there could be no industrial history, because there would be no history at all. Its indispensability in agriculture has been alluded to under the topic of rainfall (p. 10). But all this is self-evident if one stops to think; in this place we shall confine our attention to the importance of water power as a natural resource.

Water power and other power. For ages man has used the force of falling water; in colonial times in this country it was the great source of power in industry, and settlements were located where it was to be had for the mills. Numerous manufacturing towns arose along the waterfalls of New England and along the "fall line" farther south; they may use coal and steam nowadays, but their original industrial momentum came from the water power. The steam engine has rather generally replaced water power in manufacture; but the movement toward the conservation of natural resources has drawn attention back to the water-power resource. The prospect of the advancing exhaustion of the coal beds and the rise in the price of coal has set people to considering the plan of using water power much more than they do. Water power is now coming again to be regarded as a very valuable natural resource, that ought to be preserved and developed, if not for this generation, at least for a future one.

Water power of the United States. The best information upon the water-power resources of the country is found in documents of the United States Geological Survey, notably the one compiled for the National Conservation Commission in 1908, and a volume on "Water Power of the World" (1921). These show, among many other important matters, that the potential water-power resources of the country are geographically much concentrated: some 72 per cent is found in the Mountain and Pacific states, and nearly one half of the total (42 per cent) is located in the states of California, Oregon, and Washington. Therefore, unless this power can somehow be carried or transmitted over great distances, it cannot be rendered widely available. It has often been assumed that we could in time use water-power for running the bulk of the industrial plants throughout the country, but this is very doubtful.

Limits to the use of water power. Five great groups of states — the New England, Middle Atlantic, East North Central, West North Central, and West South Central — are already using power very much in excess of what they could ever, at best, get out of their water-power resources. These groups of states include a very large proportion — roughly three fourths — of the total population of the country. Water power, however developed, can never supersede all the steam and other power now in use and to be produced — not, at least, under any conditions now known. Until some new and unforeseen method is devised for extending greatly the distance over which electric power may economically be transmitted, so that the enormous power resources of the Western states can be developed and carried into the Mississippi Valley and to the Atlantic coast, the greater part of the country will have to rely, for the larger proportion of its power, on sources other than falling water.

Plant and animal life. The nature of the flora (apart from the forests) and fauna of this country has not exercised the influence on its history which one would perhaps at first sight expect. The type of wild plant and animal existing in a region is most important to a savage, and often very significant for the colonist; but when a nation has surrounded itself with the conditions of civilization, this no longer matters very much. Plants and animals can be transported about from country to country, so that it amounts to very little just where they were native — of what country they were natural resources. Also both plants and animals have been so changed by the activity of man, in breeding and improving them, that they are no longer genuine natural products, such as, for example, a pine or a spruce.

Plant and animal life of North America. However, it is not right to dismiss this topic without any consideration. We should at least recall the fact that the earlier settlers became acquainted with Indian corn here — a product destined to play a great part in commercial history, whether it can be correctly called a natural resource or not. And when we turn to the animal life native

to this country, including the fish of the neighboring waters, it is scarcely fair to say, as one writer does, that "the animal life indigenous to North America had enormous significance to the aborigines, less to the colonists, and has scarcely any to us to-day." The fur trade may be a thing of the past, but the fisheries are still with us, as a later chapter will show. In general, however, the flora and fauna of this country cannot be compared, as natural resources of a lasting type, with those other resources which have been mentioned above. Our important plants and animals are, in the form we know them, the products of human thought and effort rather than of nature. The native products are gone or are altered. Their importance is historical rather than contemporary, as will appear in the following chapters.

CHAPTER III

THE HUMAN ELEMENT

The land-plus-man unit. The basic factors of American industrial development with which we started are the land and the men — the land, with its various natural qualities, and the men, with their various inborn or acquired characters — the land, capable or incapable of affording to man such resources as he needs for living, and the men, capable or incapable of developing what the land can afford them. Always the unit of production is, we repeat, land plus man.

The men. But now we have made a broad survey of the land and its resources, and before we try to picture our national industrial development it is necessary to render some account of the human element of the problem. We now know what sort of a land the men had to deal with; and it is time to consider what sort of men there were to deal with the land. Our next topic is, therefore, the character of our country's population.

Human races. The peoples of the earth differ from one another in several respects: color, stature, shape of head, and otherwise. On the basis of these differences they have been classified into different races, say into five: the white, yellow, black, brown, and red. Such distinctions do not concern us here, for when it is a matter of industrial development, the color of a man's skin does not count if he possesses the industrial virtues. But along with these external differences go others that do concern us in our study. It is clear, for example, that the white and yellow

races are the only ones which have developed, in their own countries and without outside aid, a high civilization; and, what is more, they are the only ones which have shown the mental qualities and attainments necessary for such advance. There is such a thing as a race character, just as there is a personal character; and only the white and yellow races have shown themselves to be in possession of a race character that fitted them for the advanced industrial development upon which an advanced civilization must rest. In comparison with the white and yellow races the others appear to be backward or undeveloped.

The nonwhite Americans. There are two of these backward races which have entered to form part of the population of the United States proper: the Indian and the African. The rest of our population is almost wholly of white stock. We wish briefly to consider the Indian and the negro, first of all, after which we can devote our undivided attention to the main section — the whites — in our population. And what we shall have to say about the Indian and the negro will help us to see more clearly what qualities of mind and character are essential for a high industrial development.

The Indians. This race occupied, in pre-Columbian times, the whole of North and South America, with the exception of a narrow strip of the North American coast which bordered almost wholly on the Arctic Ocean. The Indians of North America are, in general, so much alike that they are classified only on the basis of language. The tribes that occupied what is now the United States were hunters, first and foremost; there were in America few animals capable of domestication — in any case, the Indians had not domesticated any of importance — and so they could not rise to the cattle-raising stage; and while they planted maize, squashes, beans, tobacco, and some other agricultural products, their cultivation was on a small scale. Being hunters, they had the regular character of hunters: they were brave, warlike, and resourceful. They were not as lazy as some writers give us to understand, but they lacked the qualities necessary for the development of

steady industry and a high civilization. What they might have attained to if they had been left alone we cannot say, but the fact is that they could neither withstand nor become part of the white man's civilization. They were therefore pushed farther and farther west as the white man advanced, and presently constituted an unimportant element in the country's population.

Influence of the Indians. However, it is a fact that the history of our country would not have been just what it was if the land had been entirely empty when discovered; and if we want to get some idea of the beginnings of what we now are, we cannot ignore the Indian. For as the white man moved into the country he had to meet the fierce resistance of the natives, who time and again succeeded in destroying what he had made. Again, on the other hand, the success of the newcomers was often rendered possible by their adoption of Indian methods — methods which the savages had tested out through long ages of experience and had found best fitted to conditions.

AN INDIAN CHILD'S DINNER

What was learned from the Indians. Thus the pioneers adopted the Indian dress, and learned much from him as to the location and use of the land's resources. Friendly natives saved the settlements in a number of cases by giving food or showing the settlers how to get it. The pioneers adopted Indian foods, and with them their names, such as mush, succotash. And if the Indian had not already developed the production of maize and tobacco,

certainly two very important items in our earlier and later commerce would not have been present. The Indian impress is left upon our history, and no account of American industry is complete unless something is said about the aborigines.

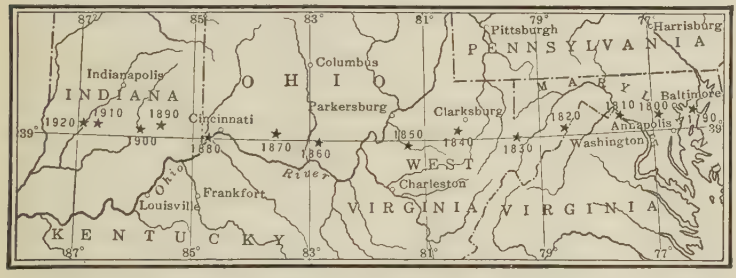
The Africans. The second of the undeveloped races which are included in our population has had a strong influence upon our national development ever since it has been here, and will be a great factor in our destiny for an indefinite time to come. The Indian has ceased to be much of a problem for us, — he has perished, or been shut up in reservations, or has come to be a part of the population little distinguished from the rest, — but the negro is always with us. The negro is one of the most significant of all American problems, and no young man or woman interested in the welfare of our native land should fail to realize it. The problem is a broad social one, but its industrial side, which is all we can undertake to speak of here, is a very important part of it.

Slavery. The negro was bought from the slave-trader because he was, at the time, the only means in sight for developing Southern resources. We have said that the effective unit is not land nor yet man, but a compound of land plus man. The man is the power that makes the land amount to something. Now there was land enough in the South as well as in the North; it was the man-element that made the difference. Let us go somewhat into the reasons for this difference in the man-element.

Conditions of settlement. In a previous connection we have seen that climate is a factor of great importance to the life of man. It was so in this country, although it did not by any means tell the whole story of the settlement. The early immigrants to this country, coming chiefly from northwestern Europe, tended to settle where the climate was not dissimilar to that of their homelands; that is, not much farther south than, say, New Jersey and Pennsylvania. And then, when the inflow came to us from the warmer parts of Europe, the South was already in possession of the negro, and the ports of entry for immigration were already

pretty well established. The tendency has been strong for the immigrants either to stop in or near the ports of entry or to move westward toward states already containing "colonies" of their own nationality. If one examines the census map, on this page, which shows the center of population of the United States as it has shifted westward decade by decade, he will be surprised to see how far north that center is and how little it has moved north or south. The line of its movement shows roughly the course of the stream of immigration.

The need of labor in the South. Thus the white race has, as it were, avoided the South of this country, even though it is not



MOVEMENT WESTWARD OF THE CENTER OF POPULATION SINCE 1790

really tropical. But this means that the land in the South was not destined to be developed by free, white labor. However, there have always been rich natural resources in the South, and there are crops of great commercial importance which cannot be raised in the North, as, for example, cotton and sugar. To meet the demand for these it was necessary to get power to apply to the land, and the only power available, before the invention of highly developed machinery, was men. But even the tropics are not uninhabited; there are men there who do not mind the heat, for they have been born and raised in it; they are, as we describe it, acclimatized. The Indians were thus acclimatized, and the Spaniards tried very hard to use them by enslaving them; but the Indian never was a good slave, being too wild and fond of liberty.

The Indians would even commit suicide rather than do slave labor. And so the white man in the tropics turned to another tropical race, the African, to get his labor supply.

The slave trade. The Spanish, Portuguese, and Dutch early began to bring negroes to tropical America as the best labor force suited to the climate; and the Northern trader, who was out after gain, made our country one of the terminals of this traffic. The story of the importation of slaves into Virginia and the South is

MAKING HARNESS AT TUSKEGEE INSTITUTE

in all the United States histories; it began almost exactly three hundred years ago and lasted about two hundred years. The negroes thrived and increased in this country, and now, out of a population of over one hundred million, about one tenth are persons with African blood.

Position of the negro in the United States. If we can suppose that there had not been any slaves at all brought into this country, we can imagine how different the industrial and social development of the nation might have been. They were used

to agriculture, and so fitted into our system; but they contributed little except the labor of their hands. From the state of slavery they were suddenly elevated, as a result of the antislavery agitation and the Civil War; they were granted citizenship and the vote.

Negro education. There have been many projects of negro education within the last fifty years. The most sensible of these have aimed to teach the negro better ways of living and the simpler trades. The hope has been that when he has learned to live more wholesomely and to be industrious and more fully self-supporting, he will be better able to advance to still higher stages of usefulness and education. The negro is at present an important factor in the industry of the South and is needed there; but he has never been an outstanding and independent figure in the development of American industries and trade. Whether he will become so in the future depends upon the opportunities accorded him, and his utilization of these opportunities.

The white immigrants. Except for the Indians, we are all immigrants to this country; but some of us are native-born and some are not. The ancestors of some of us have been native-born for a long way back; those of others of us were foreign-born not many generations ago. Let us try to get some idea of the stream of white immigration as it has flowed, mainly from Europe, into this country.

The first settlers. The first settlers in this country were predominantly from the most highly civilized states of western Europe: England, Scotland, France, Holland, and Germany. This was an excellent beginning, especially since the conditions of the time were such that the immigrants represented the best stock of these advanced countries. For the motives to migration were ambition to improve material conditions of life; independence of judgment and unwillingness to submit to intellectual or religious oppression; and other motives that spoke well for the quality of the men and women in question. Not all the immigrants were of this type, naturally enough; there were ruffians

and scoundrels; and there was a whole class of paupers or kidnaped parties who sold themselves into temporary slavery in order to pay for their passage. But in the main the early immigration drew from the best existing sources, and the quality of the population was high. Circumstances, as we shall see in the next chapter, conspired to give this population some very desirable qualities; but circumstances could have done little without the original good material to work on. The immigrants were, for the most part, serious, thrifty, industrious people, intelligent,

EARLY SETTLERS GOING TO CHURCH

well educated according to the standards of the time, quite strict in their moral codes, and, what is of the utmost importance in such cases, remarkably adaptable to the new conditions in which they found themselves. The resourcefulness of the "Yankee" began with the first settlers. In brief, they represented excellent human material to be applied to the development of the new land.

Mid-century immigration. The stream of immigration which was to form the population of our country continued to be of this general type up to the Revolution and after. As a matter of fact, however, the growth of population was due chiefly to natural increase, for up to 1820 the stream of immigration was a rather

thin one. But because of the building and completion of the Erie Canal, the planning of the first railroads, and other enterprises, there was created a demand for labor which the native population could not supply, and the arrivals rapidly increased. Small parties of Scandinavians began to arrive; around 1850 many Germans fled hither from political discomfort and oppression at home; and the potato famine in Ireland, in 1845, drove many Irish settlers to our shores. The Germans as a rule went West and took up farm lands; while the Irish generally lingered in the Eastern towns or drifted into construction camps.

Later immigration. Up to 1882 the incomers to this country were from western Europe. They were often poor and sometimes turbulent, but they managed to get along together and to unite in forming what was essentially a single type — the American. They were not too far apart in their national ways and civilization to be able to understand one another. Those who came in poverty often rose, in a few generations, to prominence in the community. There is no manner of doubt as to the value of the mid-century immigrants for the development of industry.

Immigration since 1882. But in 1882 another stream of immigration began to make itself felt — one originating in southern and eastern Europe, chiefly, at first, from Italy, Austria-Hungary, and Russia. In the year mentioned came the first inclusive Federal immigration law, and also the first Chinese exclusion act. Astonishingly large numbers began to arrive, the maximum occurring in 1907, in which year we received 1,285,349 foreigners within our boundaries. People began to wonder whether we could turn all this mass of foreigners into Americans, however effective our "melting pot." In 1896, for the first time, the incomers from Austria-Hungary, Italy, and Russia outnumbered those from the United Kingdom, Germany, and Scandinavia.

Character of recent immigrants. We shall try to sum up some of the main facts about the nature of our later immigration. The incomers are predominantly male and of middle age or younger, and physically they are selected specimens, for they have had to

pass physical tests in order to be allowed to enter the country. If it were merely a question of having a number of able-bodied males to do rough work, these facts would be favorable. But if it is desirable for immigrants to settle down and found homes, then the lack of female immigration is unfortunate. This immigration of recent decades is evidently not one of families, as it was in the earlier days. Still more unfavorable is it that the new immigration shows a large percentage of illiteracy, and that the great majority of the immigrants can, for a while at least, do nothing better than common, unskilled labor. Many of them wish only to become rich, go back home, and live in luxury there.

Can all the immigrants be made into Americans? It is perfectly plain that the newer immigration is not of as high a type industrially as was the old. The fact of the matter is that the new immigrants do not come to us well adapted to fit immediately into our life. This is due to the fact, undoubtedly, that they have lived in Europe under conditions so different from ours that their habits and ideas are very different from our own. To a large degree this can be remedied by education, and has been repeatedly so remedied in the case of the young; but it is always hard to learn new ways, especially for older people, and if the immigrants are going to come in such masses, it is a question whether we shall educate them in time to prevent them from altering our system in the direction of their own. The question is as to the capacity of the "melting pot." One thing is certain: we cannot take them as they come to us; something has to be done with them if they are going to become Americans and enter into our social and industrial system as part of it and as factors to develop and improve it. The older immigration came along, settled down, and practically took care of itself; it melted naturally into the type which we call American, and presently began to contribute to the advancement of our national industrial prosperity. All these newer immigrant races have their good points; and if they do not come in such numbers as to swamp us, by unremitting effort we can mold them toward our type.

Importance of the immigration question. These questions about the human element in our national development are matters which ought to be realized and, as far as possible, understood by every young American. We have all got to work together if we are going to succeed; and to work together we must be and must think pretty much alike. Our national resources, of which we have seen something in the preceding chapter, cannot be developed with success unless the quality of the men corresponds with the quality of the materials. The land element in production is favorable to prosperity of the highest type; we have plenty of men and shall be able to get all we need; the great question now is as to the quality of our population, and whether it will come to work together as a unit in the development of national wealth out of abundant natural resources. We are a medley of races, — the "mixing ground of the nations," — but the medley should always be melting into a single race and nation, as it did in the older times.

CHAPTER IV

SOCIAL DEVELOPMENT

The American type. In the preceding pages we have spoken of an "American type" as if it were a definite, permanent thing. There is no permanent national type; the character of no nation or people is changeless. Every living being, and every people, must adapt itself to conditions of life if it is to live; and life conditions do not remain the same age after age. Even climate changes somewhat, and many of the conditions of environment, such as the presence of forests or wild animals, have been altered greatly by man himself. No doubt if Washington or Franklin could return to earth, he would find the type of American of the twentieth century very different from that of the eighteenth.

How was it formed? However, there are elements in the environment, and in race character, which do not change very rapidly or much; if the same race continues to live in much the same environment, it is likely to retain most of its characteristics. There are also cases where different races come to occupy, one after another, the same environment, with the result of becoming similar; and at least one case, that of the Jews, where the same race has retained its characteristics, although it has scattered widely over most earthly environments. Also it is true of races, as of persons, that "as the sapling is bent, so is the tree inclined"; it is of great importance to a person how his childhood was passed, and to a nation how it began. For the experience of earlier stages of development is likely to leave an impress which only a long

time and great difference of life conditions can remove. We wish, in this place, to indicate some of the important factors which have contributed to form what we call the American type — the one to which we hope that our immigrants will approach as they live on among us. As we are writing about industry chiefly, we shall give most attention to the industrial side of the American type, although there are many elements of a social and political nature that must be mentioned, since they deeply affect industrial life.

Frontier society. The early settlers came, as civilized men, into an undeveloped region of the temperate zone. They founded a temperate frontier society. This is a very significant fact, for it draws in its train many marked social consequences. Here is a place where climate has exerted a great influence over the life of man. For if two frontier societies, composed of the same national stock, one of which lies in the tropics and the other in the temperate zone, be set over against one another for comparison, a contrast due almost wholly to difference of climate is immediately evident. It is perhaps well to touch upon that contrast, first of all, for it will assist us to understand the differences between the South and the North of our country; for while our South is not tropical in the strict sense, yet it extends to the borders of that belt and comes somewhat under its influences. But we shall bring out this contrast by first describing briefly, and principally for the light it sheds upon the temperate frontier society, the outstanding characteristics of the frontier society or colony of the tropics.

The tropical type of frontier society. The effect of the tropical climate upon the white man is enervating, where it is not worse (p. 9). It is harder upon women, and especially upon children, than upon men; and so the tropics are but thinly populated by the white race, and most of the whites are males. This means that the white race cannot keep up its numbers in these regions. If the men who stay there for years marry, they are likely to take native wives and produce a race of half-breeds. The permanent element in the population is the acclimated native; or, in the case of the tropical regions of America, the American

native plus another tropical native — the negro — who has been brought in to do the labor which the white man cannot perform. This makes a set of differences in the population, which divides into classes, with the aristocrats at the top and the slaves at the bottom; the population is not of the same kind, or homogeneous, throughout.

Economic dependence. If the tropics had had no natural resources, or if these had been the same as those of the temperate zone, the white man would not have been interested in them. But in the warmer regions there can be produced certain things which are in great demand in northern latitudes, — cotton, sugar, spices, rubber, — and precious metals were to be gotten there. Cotton and sugar, however, cannot very well be raised on the small scale; and the demand was such that the tropical colony generally confined itself to raising one staple crop. If that crop succeeded, there was wealth; if it failed, destitution and dependence upon outside help. All the eggs, so to speak, were in one basket. And the methods of production were wasteful, for the white man, or his chartered company, was after immediate profits. The settler did not expect to stay long, and if he could make his pile, cared little for what he might leave behind him. He cared nothing for the country; it was not to be his home. A one-crop country must necessarily be a dependent one economically.

Political dependence. And it was likewise politically dependent. The natives and half-breeds were the permanent element in the population and far outnumbered the whites; and they were generally so treated by their masters that they hated them cordially. The few white aristocrats and owners at the top of the social scale had to depend all the time upon the support of the mother-country, and had no desire or impulse to break away and form an independent state. So the tropical colonies have, as a whole, remained politically dependent upon some northern power and have not grown into modern independent states. They have remained in a protected relation, as "protectorates" or crown colonies, administered by a governor sent out from the mother-country; and

even in those cases where they are nominally independent they are not stable states like the United States and Canada.

The temperate frontier society. In striking contrast with such conditions are those typical of a colony founded in the temperate zone. Of all such societies which have at length become great nations, no other has attained such prominence as has the United States; it is the most outstanding example of the developed frontier society of its type. Consequently, as we pass now to the frontier society of the temperate zone what we shall have to say will be almost wholly with reference to our own country — the foregoing sketch of the conditions of a tropical colony having been introduced chiefly with the idea of causing the contrasting conditions of our own country, in its earlier stages, to stand out more clearly. Particularly to be noted is the influence of these conditions in forming and molding the "American type" to which we have several times referred.

Population. If the white man moves from Europe to a new country of approximately the same temperate climate as that to which he is accustomed, the change is regularly beneficial to him in a physical way. It stimulates him; there is no enervation like that of the hot lands. There is nothing in the change, either, that is deadly to the women and children; in fact, the rate of increase of a European population regularly rises when it has moved to the new land. And although the hardships of the frontier put something of a curb on the migration of women and children, and although there is always a preponderance of males in such regions, still colonization in the temperate zone is largely by families rather than by male individuals. It is the more so because the intention of the immigrants is permanent settlement rather than transitory fortune-making. The result of this is that the whites breed within their own race and that there are fewer half-breeds by far than in the tropics. And this means that the population is more of a single type — more homogeneous. It is physically sturdy, rapid of increase, and largely unmixed. It pushes the natives aside without intermarrying much with them, and holds the land by and for itself.

Labor. In this climate, also, the white man was able to work as he could not in the tropics; far from injuring him, work was a good thing for him. Nature did not drop gifts into his lap, — to live he had to bestir himself, — but she rewarded effort with generosity. There was no need of an acclimatized labor force; and although negro slavery was tried out in the North, it was found that slave labor could not compete with free labor, and the experiment was not carried far. Meanwhile the free labor poured in with the stream of immigration and settlement.

Resourcefulness. This free population, however, was obliged to become adaptable and resourceful, for there was not much aid from without. There was little in this country that represented a desired novelty in Europe — no one of those tropical products, such as spices, sugar, coffee, for which a large demand existed. The Spaniards, who were after such products, and also precious metals, paid hardly any attention to America north of the Gulf of Mexico. The fur and tobacco trades, involving concentration on single products, were nearest like the enterprises which were characteristic of the warmer lands. In general, where the tropical colonies have set their fortune on raising a few luxuries on the large plantation scale, remaining almost dependent upon the mother-country for necessities, the temperate colonies have been destined to raise a variety of necessities, on the small scale, and so have, by providing for their own needs, become independent of outside aid. The eggs were in several baskets. Our forefathers produced few things that were not produced in England, and, on the whole, received little help in working out their fate. But this meant that they had to be alert and adaptable to conditions if they were going to get on; they had to be full of resource and do things for themselves somehow. The boy who is helped over every difficulty by his father develops little energy and resourcefulness; but when a boy is thrown on his own powers, he often shows astonishing ability to take care of himself.

The Yankee. So it was with the colonists; the "Yankee" got so he could turn his hand to anything, and his inventiveness and

resourcefulness in meeting the many dangers and needs of existence in a rough environment have made him a proverb. The stamp set upon him has come to be a sort of national tradition. Our history has been full of alert and clever action, in good causes and in questionable ones; and in respect to mechanical invention applicable to industrial development we are equal or superior to other nations. It belongs to the American type to show such qualities; and they were first developed by the colonists, especially those of the northern section of the Thirteen Colonies, in their effort to cope with their life conditions.

Democracy. But now there was another set of elements that entered to mold the national type. Our country was the first of a number of powerful modern democracies. But democracy does not simply happen. Let us see what there was in the beginnings of our history that made for equality, freedom, and independence.

Equality among the settlers. There was no great fortune to be made by settling in temperate North America; it attracted no Pizarro. It was no place for men with great wealth, for there was no big enterprise, except the fur trade, to invest it in. And it was also no place for lazy paupers or plundering ruffians. We have seen that the earliest settlers came here because they wanted to live and believe as they wished — in respect to politics and religion, for example. In other words, the early immigration to this country was that of people on about the same level of wealth and social standing — pretty much alike, and each thinking himself about as good as the next man. There were exceptions; but the stream of immigration was, as a stream, composed of similar elements.

Equality due to conditions of life. And when the settlers got here, the conditions they met with helped along the feeling of similarity and equality, and speedily leveled any pretensions of superiority resting on birth and social condition. There was no need for any man to remain inferior to any other man; and so it was impossible for any man to maintain superiority over others, unless such dominance rested upon real qualities that were daily tested out, before all men, in the life of the community. The

landlord could have no such position as he had in England, where there were more men and less land; if a man did not want to pay rent for land, he could move on into the country, clear some land, and be his own landlord; if he was not paid wages that made him virtually his employer's equal, he could become his own master easily enough. The easy reversibility of the positions of employer and employed is illustrated by the story of the employer who hired a man and paid him in corn and sheep. Presently he told his employee that he could hire him no longer, as he had already paid him nearly all the property he had. "Very well," replied the workman, "you can now work for me and earn it all back."

Independence. Now this sort of a situation made people very independent and gave them a feeling of the equality of men. It is still to be seen in less developed parts of the country and among populations that have remained more true to the colonial type, where servants are "help," and you do not get things done for you very readily, although the people are not wealthy and are eager to earn, unless you put it on the grounds of asking a favor. Furthermore, there was an even wider feeling of independence that came from the self-sufficiency of the communities. Producing, as they did, a variety of necessities rather than a single article of export, such as sugar, these communities were not economically dependent; they could live on their own supplies without support from outside. Nor did they need constant protection from the mother-country against the natives or the slaves, as colonies in the tropics are likely to need it, owing to the fact that the native and slave element is always preponderant in numbers. And this independence in the economic and social fields had the inevitable effect of making the population feel politically self-sufficient. Political freedom and individualism characterized the temperate colonies; and all of them have gradually worked themselves out into political independence. They have all become independent states; and the strongest of them is the United States, which led off in declaring its independence of outside control. And no one should be deceived into believing that Canada,

Australia, and other temperate sections of the British Empire are the less independent in reality because they still acknowledge a nominal bond with Great Britain.

Prosperity. Something of the effect of frontier conditions in a favorable region upon determining the type of population can be seen from preceding paragraphs; our beginnings in this country certainly had a strongly molding effect upon American society. The founders of our nation were a fine racial stock, to begin with; then they were set down amidst conditions which conspired to make and keep them adaptable, resourceful, ambitious, self-reliant, and independent. They prized industry and talent; and they especially prized education. A man with an alert and well-stocked mind had a chance in this country that he could not well complain of; a far better one than could be gained by accident of birth. What wonder, then, that Americans have developed an unparalleled national prosperity, beginning with such richness of natural resources, a population of high quality, and a social organization so favorable to the display of the best qualities of the people!

Persistence of the frontier. However, it is possible to make a good beginning and then to fall away from it and wander off on other paths. It was one of the great advantages of this country that it long had with it the frontier influences which we have sketched. These influences on national life were not lost, because we had the frontier always with us. Once the states of the Atlantic seaboard were our frontier; then it was western Pennsylvania and New York and the rest of the strip west of the Appalachians; presently it was the states just east of the Mississippi; then those just west of this river; then the Far and Farther West. Always the frontier moved westward, but it never ceased to show such conditions as have been outlined, and to react, through the influence of its life, upon the life of the nation. We had an immensity of land for the population to move into; the pressure of population on land could not become heavy, for there was always an outlet and a relief. The country was always underpopulated.

Men at a premium. But where there is much land and few men there is a demand for men, and men are at a premium; and when men are in demand, that means that there are high rewards for their services and efforts — good profits, high wages, considerate treatment. This gives the men self-respect, independence, and other valuable qualities, just as enslavement demeans them and makes them cringing. Prosperity may even make them conceited, self-assertive, overconfident, and contemptuous of others; material success may make them blind to things of a less material value. The American type has doubtless impressed foreigners as boisterous, raw, and bumptious; but it has been strong and wholesome, with capacity for growth and improvement. Industrially it has astonished the world with its performances. And, on the whole, it has pulled together, showing itself capable of preserving its integrity despite the huge influx of aliens; in fact, it has impressed itself upon these foreign elements in such manner as to draw them into the nation as real parts of it. In general, there has come out of the melting pot a pretty consistent product.

The passing of the frontier. This country is still partially frontier; it is still underpopulated, having only some thirty-odd to the square mile, as compared with older countries, where this figure runs into the hundreds. However, it is filling up, and the frontier character of the society is vanishing. As the land loads up with population the conditions of life cannot help becoming more and more like those of older countries — men will be less in demand because there will be more of them in proportion to the land; and so there will no longer be in existence those frontier advantages of which we have spoken — equality of opportunity, freedom of individual action, and so on. If the American type is not to be altered, we shall have to give some effort to preserving it; here is a case of conservation of natural resources which has escaped the attention of some conservationists.

American social life. In the last two chapters we have doubtless appeared, at times, to be getting rather far away from American

industrial development. But the development of the industries in a society is not a thing by itself, apart from all others; it is intimately linked up with all other parts of the social life. The human element must be reckoned with, and also the manner in which the human element has developed in the mutual relations of men with one another, as they live on together in the community and the nation. Industrial and political development are always more or less interconnected; it could even be shown that the type of a people's family or religious life influences to a considerable degree its type of industrial life. In these last two chapters we have tried to introduce enough, but not too much, concerning the influence of factors that are not directly industrial, in order to give the student a broader outlook upon the nature of industrial development than he could get from mere facts and figures of a strictly industrial order. We are now the better fitted to understand the meaning of the facts and figures having to do with the several most important of our national industries, and with our trade.

PART II. AGRICULTURAL INDUSTRIES

CHAPTER V

CEREALS

Agriculture. In telling about the various ways in which the population of this country has dealt with its natural environment to make a living, we shall begin with the agricultural industries. This is because farming was in colonial times, and is now, the foundation of all industry. All the needs of man for food, clothing, and shelter are supplied by products of the soil; for all animal products would disappear along with all the animals were it not for the food supplied by plant life and derived from the earth. Agriculture is, as Napoleon is reported to have said, "the foundation of commerce and manufacture." Many of the raw materials important and indispensable for manufacture are derived from agriculture, to say nothing of the farmer being the producer of food to support human life in general. Agriculture is an industry that cannot die or lapse unless the race is to pass away. Other industries may be temporary — mines may become exhausted — but agriculture must persist. It goes without the saying that agriculture is always a powerful bulwark of national strength.

Agriculture and the physical factors. As compared with other industries agriculture is more intimately dependent upon the

physical factors of natural environment reviewed in our first chapter; indeed, these factors are the really determining ones in the production of crops. And this is said in full realization of the powerful influence upon those other industries which is exercised by climate, weather, water supply, and the other factors mentioned above.

Agriculture in the United States. Agriculture has always been the foundation of American industries and trade; it has been the principal source of our wealth. Throughout the whole colonial period it was the main industry; in fact, it was the only really dominant employment of the country until the beginning of the nineteenth century. Even in sections which derived considerable income from fishing and commerce, such as New England, agriculture was nevertheless the foundation of things. Up to 1880 fifteen out of twenty-one presidents of the United States were farmers or the sons of farmers. Not until 1880 did the combined value of all the manufactures of our country surpass the value of the agricultural products; and, in spite of the tremendous advances made in our manufactures during the last few decades, the total population "gainfully employed" is about equally divided between those engaged in agriculture and those engaged in manufacturing, the latter including, in the present instance, hand trades as well.

Our preëminence in agriculture. We have also surpassed all other countries in agricultural development; we lead in the annual value of farm crops produced. This preëminence is due to a combination of favoring factors, some of which have been mentioned above: diversity of fertile soils; diversity of climatic conditions, so that numerous crops can be raised (in the wheat belt, corn belt, cotton belt, tobacco belt, etc.); an energetic and resourceful population; coöperative state and Federal departments of agriculture, which further the interests of scientific methods; and a highly developed transportation system, allowing of the ready marketing of crops. The following are representative types of agricultural industries.

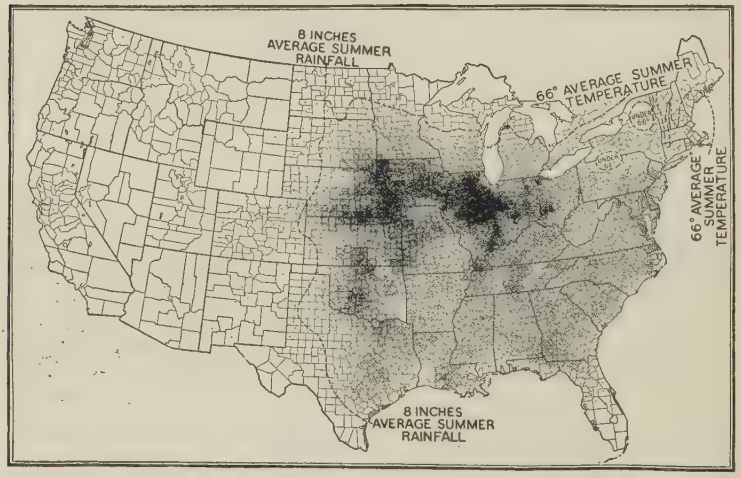
Cereals. Cereals hold the leading place among the great variety of foodstuffs raised by man for himself and for his domestic animals. The most important cereals are maize (Indian corn), wheat, oats, barley, rye, rice, and sorghum (including the millets). Buckwheat may be added to this list, though it is not strictly a cereal. The cereal crop has always occupied the larger part of

FIELD OF MAIZE

our cultivated land, and there are produced in this country, in an average year, upwards of 5,000,000,000 bushels of cereals, having a value of $6,000,000,000 or more.

Maize. Maize was the only cereal of importance native to the Americas. It was probably not native to the United States. However, when Europeans first opened up the New World, this plant was being raised from Canada to southern Chile, and was a staple vegetable food of the Indians. In colonial times it formed the principal food crop; and it held its position until wheat

was brought in from Europe and became common. Maize was the great gift of the Indians to the white man; the colonists quickly adopted its cultivation from the natives, and it was lucky for them that such a resource existed. Maize comes to maturity speedily and its yield is large, although it requires less cultivation than almost any other food crop; it was thus wonderfully adapted to crude pioneer farming. In colonial times the amount produced



DISTRIBUTION OF CORN-PRODUCING AREAS IN THE UNITED STATES

After map from United States Department of Agriculture

in New England was comparatively small; but other colonies — New Jersey, Pennsylvania, Delaware, the two Carolinas, and Georgia — were exporting corn extensively; and Virginia exported, more than once, over 575,000 bushels. This grain surplus was exchanged for necessary European products.

Corn in the West. It was the opening up of the West that paved the way for an unheard-of development of corn production, for the real cereal belt of the country lies west of the Alleghenies. The completion of the Erie Canal, in 1825, and the later construction of railroads insured cheap transportation for the crops;

and the fact that corn turned out to be an excellent food for cattle and hogs stimulated production. In some years there was so much corn in the West that it was used for fuel. About 1870, in certain districts, corn was considered a cheaper fuel than coal at nine dollars a ton — and this does not refer to the cobs alone, but includes the grain on the cob. Perhaps we could not find a better illustration of the natural productiveness of the Western farms than this case of burning up as fuel a food now in great demand in the world.

The corn crop. In 1870 our corn crop for the first time exceeded 1,000,000,000 bushels, and in only three years since (1871, 1873, and 1874) has the yield been under that figure. No country has ever surpassed ours in corn production, nor have we any serious rivals in this line. We raise about four fifths of the world's corn; and this crop easily leads our others in money value, as well as in acreage and quantity produced. About one half of the corn is raised in the "corn belt," which includes the states of Kansas, Nebraska, Illinois, Iowa, Ohio, Indiana, Texas, and Missouri. The average yield is close to 30 bushels per acre.

Corn exports. Until recently our exports of corn were small. This may be accounted for by the large home demand, by the lack of necessary facilities in Europe for milling corn, and by the failure of Europeans to prize corn as food for man to anything like the degree it deserves. Even during the Great War some of them seemed to think it a hardship to be obliged to use corn (maize) instead of wheat. Partly as a result of the war there has been in recent years a marked increase in our exports of maize, owing largely to purchases by certain of the European nations. The result is that maize, instead of being a minor export, now holds a somewhat conspicuous place among the exports of the United States. There is still, however, a big home demand for our enormous yield of corn, so that the percentage exported is small. This small percentage represents, however, a great number of bushels. Maize is still the great stock food, and much of our exports is "on the hoof"; that is, in the form of beef and pork.

Wheat. The use of wheat bread as a staple article of diet is now regarded as a mark of higher civilization; wheat is a sort of aristocratic food. This is a kind of tradition, though there is some sense in it, for it is not so much the superior value of wheat for sustaining life that makes it desirable as it is its greater attractiveness, both in the matter of taste and in the great variety of forms in which it may appear upon the table. There is a good deal of fashion in foods, as well as in dress, and wheat is the fashion among civilized nations of the Occident; it is preferred to corn, as we have seen, for corn is regarded much as Dr. Johnson regarded oatmeal — as horse food for the civilized Englishman, although Scotchmen, whom he hated, were low down enough to eat it. This nonsense of fashion extends even farther; for it is the fashion to insist upon using wheat flour which is almost perfectly white, but whose whiteness results from getting rid of what is the most nutritious part of the wheat grain. However, the use of "whole wheat" is becoming, with the extension of real knowledge about the constituents of the grain, somewhat more the mode, and is insisted upon by some people who wish to be considered scientific in the matter of their eating.

COLONIAL GRIST MILL

Wheat in the colonies. Wheat was not known in America before Columbus; but in the Old World its cultivation reaches back to very ancient times — in fact into prehistoric ages, for wheat grains have been found in the ruins of Swiss lake dwellings. We cannot be sure about the exact circumstances of its introduction

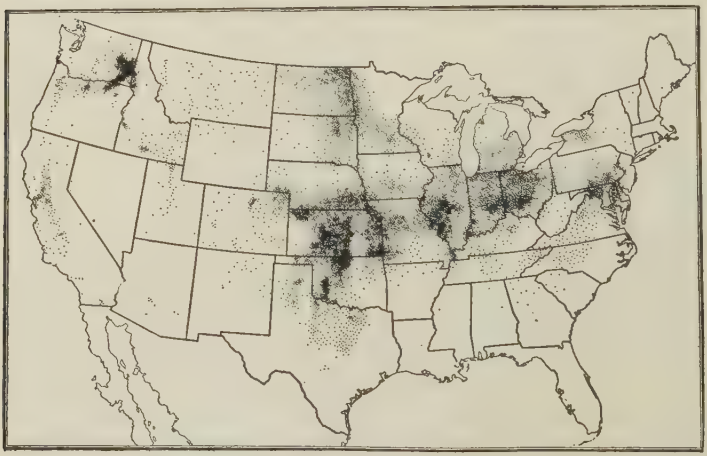
into America. There is a story of a Spaniard who found a few grains mixed in with his rice, and who carefully picked them out and planted them, thus introducing the cereal into the Spanish-American colonies. Wheat was probably brought over by early English colonists and sown by them. For a time Virginia gave considerable attention to its culture, several hundred acres

HARVESTING WHEAT

having been sown to wheat as early as 1648; but the tobacco crop proved to be so much more profitable in Virginia, despite the demand for wheat, that the latter was allowed to decline. Wheat was early grown in New England, but there seems to have been trouble in raising the crop, so that the colonists fell back on corn and potatoes. Wheat almost passed out of cultivation with the opening of new lands in the central colonies, just as the wheat production of the Atlantic states declined in the face of the superior productivity of the Mississippi Valley in the middle of

the nineteenth century. But at the time of the Revolution wheat was one of the leading exports of the Northern colonies, and the prominent wheat producer of 1750 was New Jersey.

Wheat in the West. About the middle of the next century the center of wheat-raising began to move rapidly westward. In 1849 only a little over 5 per cent of the total wheat crop was produced in states west of the Mississippi, while the Atlantic coastal states

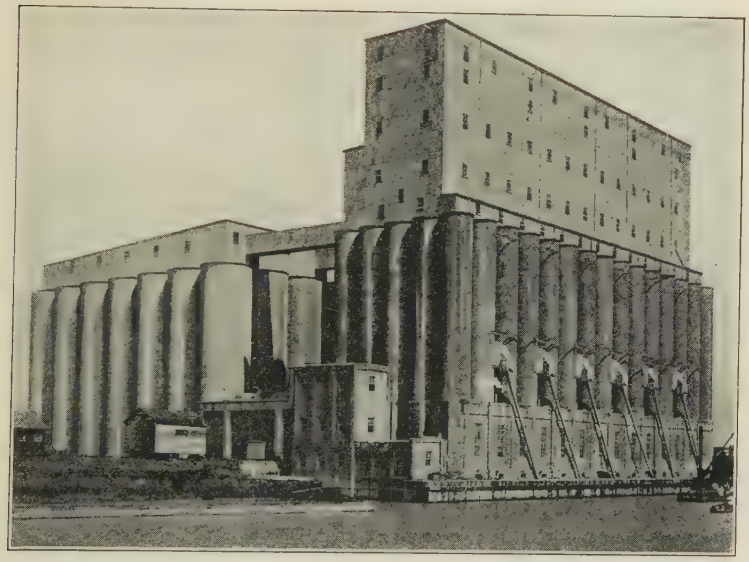


DISTRIBUTION OF WHEAT-PRODUCING AREAS IN THE UNITED STATES

After map from United States Department of Agriculture

were responsible for over half. Pennsylvania was then the chief wheat state in the Union. But by 1869 the Atlantic states were raising only a fifth of this crop, and the center of production was swiftly moving into the real "wheat belt." This was due to several causes, such as the rapid settlement of the prairie lands of the Ohio and upper Mississippi valleys, the suitability of the climate and soil in those sections, the development of railroads toward the west, the improvement in agricultural implements, the invention of the threshing machine, and other such preparations for culture on the grand scale.

The wheat crop. Our country contains the greatest wheat fields in the world. The largest yield of wheat that we have ever had in a single year was 1,025,801,000 bushels, in 1915. The center of its production is close to the southwest corner of Iowa, having moved, since 1850, more than nine hundred miles west and somewhat north. Our crop amounts to about one quarter of the world's product. The average yield per acre in the United States



AN IMMENSE GRAIN ELEVATOR IN THE WEST

is under 15 bushels; if much care is given to the crop, where it is not raised on a large scale, the yield is considerably greater than this figure.

Industries connected with corn and wheat. Connected with wheat and corn production are many manufacturing industries, such as milling and bolting the flour, and a number of storing and transportation industries. Grain elevators and transportation agencies give employment to much capital and many men. Of an average annual crop of about 800,000,000 bushels of wheat we

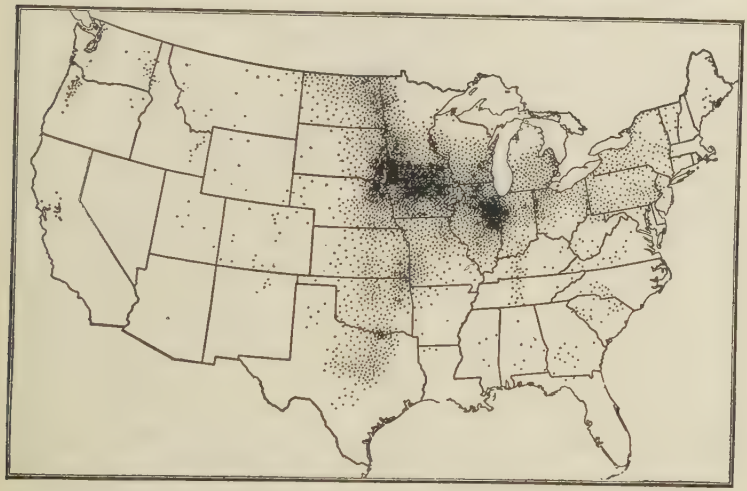
need by far the larger share for our own use; the remainder is exported either in the raw state or in the form of flour. The Great War called into use in America a great variety of wheat substitutes, so that unusually large shipments of wheat might be released to be sent to the Allies.

Oats. This is one of the grains which has been in some countries unpopular as a human food, but in northern Europe

FLOUR MILLS AT MINNEAPOLIS

it is much used for that purpose. Said a Scotchman who was joked by an Englishman because men ate in Scotland what horses ate in England, "That is why you have good horses in England and we have good men in Scotland." In this country oats are used chiefly as stock food, and by man in the form of oatmeal, rolled oats, etc. There was a sort of wild oat, called pin-grass, native to this country, but the variety we use was introduced from the Old World, where it was used in very early times.

The oats crop. The cultivated variety of oats was introduced into America near the beginning of the seventeenth century, and in colonial times oats formed an important crop in New England and the middle colonies. The plant thrives best in a fairly cool and moist climate; the leading oats-producing states have always been the northern ones; at the present time 80 to 90 per cent of our crop is raised in the North Atlantic and North Central



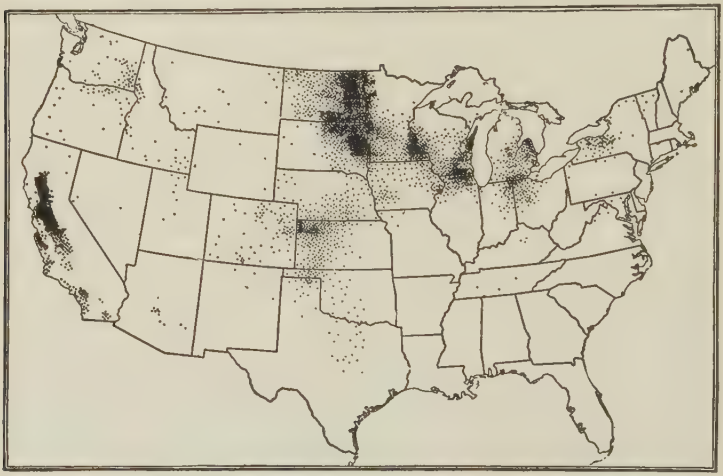
DISTRIBUTION OF OATS-PRODUCING AREAS IN THE UNITED STATES

After map from United States Department of Agriculture

states. As early as 1840 the annual crop amounted to 123,000,000 bushels, and development has been so rapid that we now raise about 2,000,000,000 bushels a year — a larger yield than any country, although European Russia has been a rival. The average yield per acre is not far from 30 bushels — much larger than that of wheat and slightly above that of corn.

Barley. This is one of the earliest of cultivated cereals. The plant is very hardy and will stand considerable cold, but it can be grown successfully in a comparatively warm climate; thus it is adapted to a wide range of conditions. Until rather recent times

barley has been used extensively as human food, and barley bread is still a common article of diet, especially for the poor, in certain regions; but as wealth and civilization have extended, wheat has supplanted barley as human food, and barley has been used almost solely for animal food and for malt. More of the world's barley is produced in Europe than in any other continent.



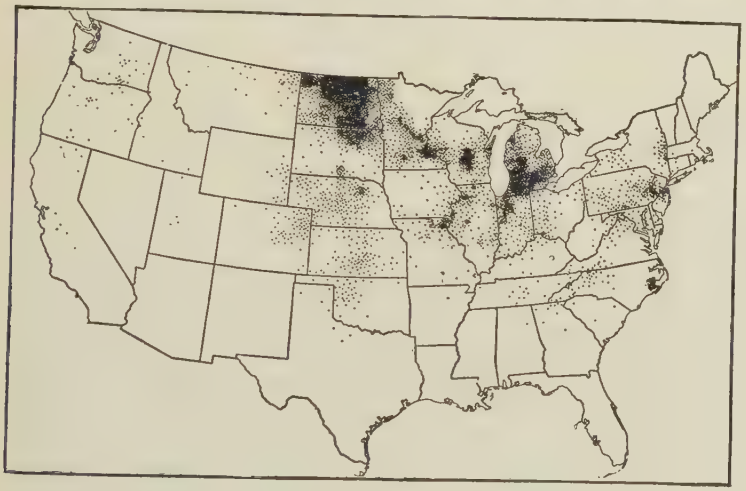
DISTRIBUTION OF BARLEY-PRODUCING AREAS IN THE UNITED STATES

After map from United States Department of Agriculture

The barley crop. This grain was introduced into the colonies early in the seventeenth century, being sown in Massachusetts in 1620, and in Virginia in 1611; in the latter region it soon declined before the dominant tobacco production, but it remained an important crop in the middle colonies and New England. Barley never got a real foothold in this country, however, until recent years. In 1840 we raised a little over 4,000,000 bushels, and as late as 1870 less than 30,000,000. But at present the barley production is on the rapid increase; in 1900 the area sown to barley was still less than 3,000,000 acres and the harvest was 59,000,000 bushels, but since that time both the acreage and the

production have greatly expanded. The crop is raised chiefly in Minnesota, the Dakotas, California, Wisconsin, and Kansas.

Rye. Rye is a close relative of wheat, but its cultivation began much later than that of wheat and barley; it was not cultivated in the Roman Empire much before the time of Christ. It is an extremely hardy cereal, will grow on poor soil, and will stand a



DISTRIBUTION OF RYE-PRODUCING AREAS IN THE UNITED STATES

After map from United States Department of Agriculture

severe climate. Once rye was much used for human food, and is so used now in Europe, notably in Scandinavia, North Germany, and parts of Russia, where "black bread" is a staple food of the peasants. Elsewhere it is mainly a cattle food, or it is used in making intoxicants, such as vodka in Russia.

The rye crop. Rye was to be found under cultivation in this country in 1648. By 1801 the country exported nearly 400,000 bushels, and rye production spread pretty generally over the Northern states. In colonial times it was commonly used as human food, being mixed with Indian meal in bread-making; and this sort of bread for a long time remained popular in rural New England.

But rye has not shared to any great extent in the agricultural expansion of the country; its march westward has lagged far behind that of other cereals. The acreage of rye is to-day a good deal above that of thirty or more years ago, and since the yield per acre has increased to about 14 or 15 bushels, the annual crop has grown considerably; it averages under 80,000,000 bushels, however, out of a world crop of many times our yield. The states raising the most rye are Wisconsin, Minnesota, Michigan, the Dakotas, and Indiana.

HARVESTING RICE WITH MACHINERY

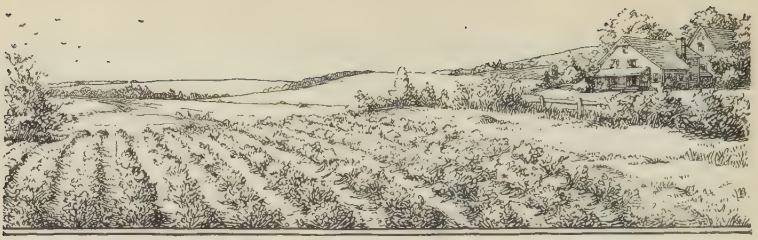
Rice. Wild rice is found over wide areas in the United States and is rather common in the north central part of the country. It was parched by the Indians. But the rice of commerce is an imported product, probably native in southern Asia, where it was cultivated ages ago; it was brought comparatively recently to Europe, supposably by the Moors into Spain. White rice is the variety originally introduced into this country.

The rice crop. Rice was introduced into Virginia in 1647; into South Carolina, by accident, from a sailing vessel from Madagascar, in 1694; into Louisiana in 1718. It took first place in the

agriculture of South Carolina. About 1700 it became an important export article, being in much demand in Europe and the West Indies, and its culture spread rapidly. By 1850 we were raising over 215,000,000 pounds a year, of which South Carolina furnished 160,000,000 pounds and Georgia 39,000,000. The Civil War nearly killed the industry; labor was demoralized, and the dams and gates, used in flooding the fields, got out of repair. Since the war the industry has slowly recuperated, but its center has shifted; Louisiana, California, Arkansas, and Texas now lead. Our present crop is between 35,000,000 and 52,000,000 bushels a year. The yield per acre is relatively large, so that rice makes a cheap food for people on a low scale of living, as in the East; in wheat-eating countries, like ours, rice is unduly neglected as a staple food, being used rather as a table delicacy.

Sorghum. There are many varieties of sorghum, several of which are grown in this country. The seeds are used as food for man and beast, as well as for making alcoholic beverages. Sweet sorghums are a source of sirup and sugar. The brush of the broom-corn variety is made into brooms. Some varieties are used widely for hay and silage. The sorghums flourish in warm, dry regions, being notably resistant to drought. They play an important part in the agriculture of the southern part of the Western High Plains region, but are by no means confined to this area.

Buckwheat. This is not really a cereal, but is allied to plants like the dock, sorrel, and smartweed. It was brought to this country by the Dutch and sown on Manhattan Island for horse feed. The seed is now used to some extent as poultry food; and the plant is sometimes raised solely for the honey it yields to bees. As everyone knows, its chief appearance upon the table is in the buckwheat griddlecake. It has been grown chiefly for home consumption, and production has not flourished. In 1840 about 7,000,000 bushels were raised; in 1860 about 17,500,000 bushels; in 1870 about 10,000,000 bushels; to-day the yield is between 13,000,000 and 20,000,000 bushels, of which New York and Pennsylvania raise more than half.



CHAPTER VI

VEGETABLES AND FRUITS

Their importance. The importance of vegetables and fruits for the well-being of men does not need to be explained to anyone; but perhaps we now understand better as a people than we ever did before the importance of producing these foods. Vegetable gardens can be located almost anywhere throughout the country, and even in city lots.

Early conditions. Most of the vegetables and fruits commonly raised in this country were not native to it; in fact, only a few of them were native to the New World. The Indians had recourse to certain berries, nuts, and wild fruits, and they cultivated rather widely beans, squashes, and other minor vegetables; but nearly all the vegetables and fruits of commerce were developed in other countries and were introduced here by the settlers. This was done so much as a matter of course that we have but little information concerning the origin and first stages of the vegetable and fruit industries of the country; almost everybody, in earlier times, did some gardening on the side; the clergyman, the lawyer, and even the physician were in some degree farmers. In fact, any one of these professional men might have to collect his fees, on occasion, in produce — "in kind," as such payment was called — for in the new country there was often a dearth of money. Rents were not seldom arranged to be paid in kind; so that, in reality, garden products attained a dignity now held by coins, bills, and checks.

Later conditions. Gardening of this sort was on the small scale; the raising of fruits and vegetables for commercial purposes dates, in this country, from about the middle of the nineteenth century. Up to that time they were raised for local consumption, for the most part, and were eaten, of course, only in season. The idea itself of having vegetables and fruits out of season reaches back only a few decades, and was started by certain Northern cities that had good transportation connections with farming districts not far away. But with the advance of transportation, centers of population were enabled to extend their reach and their demand. Once the movement was well started, large areas, particularly in the South, came to be devoted to garden crops; and there are now whole sections of the country whose agricultural efforts are devoted almost wholly to supplying Northern markets with fresh vegetables and fruits out of season.

Transportation of vegetables and fruits. This whole movement, as is easily seen, depends upon the excellence of the transportation system. The carrying trade for garden products and fruit from South to North was in the hands, first of all, of the steamship lines; and it is said that the first consignment dates from 1847, when a small quantity of lettuce, radishes, mint, and strawberries was brought to New York. In the spring of 1885 arrived the first all-rail shipment of garden truck from the South to New York. In the eighties came the first carloads of oranges from Florida, and about that time the first large consignments of strawberries. From these small and recent beginnings there has developed an enormous trade, which is by no means confined to business between South and North; for there is a flow of vegetables and fruits to every town and city from its more immediate agricultural environs. Indeed, the population is becoming somewhat spoiled by the luxuries it has thus gained, and people are coming to feel it a hardship if they cannot have these extraordinary advantages which were denied to all humanity up to recent years. The former luxuries are coming to be thought necessities — necessities that one must have, however much the having of

them increases the cost of living. But, on the other hand, it must be realized that the very existence of great centers of population would be impossible were it not for the development of food transportation on a large scale and from greater and greater distances.

NEW POTATOES

A POTATO PLANTER

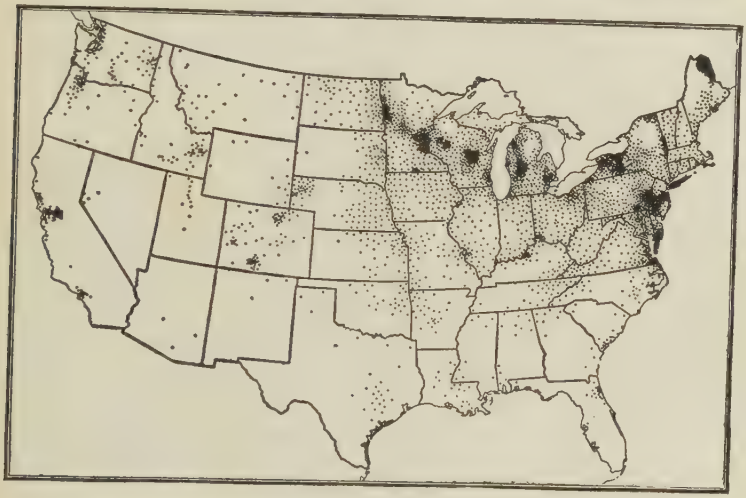
We shall now enter into some details respecting the raising of the several most important vegetable and fruit crops.

Vegetables

Potatoes. The potato is very rich in starch, and is a widely consumed and favorite food in both Europe and America. Next to bread, the potato is the staple food in this country; indeed, it enjoys a reputation of superiority which has led less-informed people, in time of scarcity, to provide themselves with it at an immensely increased price, when such a food as rice remained comparatively cheap. They have believed, mistakenly, that potatoes were a real necessity for people doing heavy manual labor, and have rebelled against using substitutes.

The potato crop. Both the white and the sweet potato are native to America. The former grew wild on the plateaus of both

Mexico and western South America, and was there encountered, in the sixteenth century, by the Spaniards. It was early introduced into the colonies and has long been produced as a food for local consumption. But as a commercial item neither the white nor the sweet variety attained much prominence until about the middle of the nineteenth century, when the development of transportation — here again the condition allowing of wide industrial expansion



DISTRIBUTION OF WHITE-POTATO-PRODUCING AREAS

After map from United States Department of Agriculture

— made shipments possible. At present potatoes stand sixth on the basis of annual farm value,— that is, value before leaving the farm,— being surpassed only by corn, cotton, hay, wheat, and oats. Though widely cultivated, the potato is raised for the most part in the northern and eastern sections of the United States; Minnesota, Wisconsin, Michigan, New York, Pennsylvania, and Maine are prominent producers, and the irrigated regions of the Far West are beginning to contribute copiously to the annual yield.

Potato cultivation. The average yield per acre for potatoes is between 90 and 100 bushels — a large figure as compared with

the average for wheat. But in order to raise a good potato crop, much more care and expense have to be undergone than in raising wheat and other cereals; wet weather, dry rot, and the potato bug (Colorado beetle) are dangers to the crop that must be endured or provided against. Taking into consideration our immense agricultural area, our yield of potatoes is relatively small; in a normal year France produces more than we do, while Germany's crop is two or three times as large as ours. Even the United Kingdom raises about two thirds as many potatoes as are grown in the whole United States. The possibility of increasing our potato yield is almost unlimited.

NODULES ON ROOTS OF BEANS

Beans and peas. These include many varieties and are known as legumes. They have nodules, or warty-looking protuberances, on their roots, where are to be found millions of microscopic bacteria having the power of making nitrates from the free nitrogen of the air and of storing up these nitrates in the plants. Hence, if the roots of the plants are left in the soil, it becomes so much the richer; and one way of fertilizing poor soils is to sow a crop of legumes and then plow the whole crop in.

The crop of beans and peas. Peas and beans have long been grown in this country, both for human food and for cattle fodder. The natives raised some varieties before the white man came; and they were planted as early as 1602 in New England, and 1644 by the Dutch. They were raised also along the southern Atlantic coast, and were even exported, in small quantities, before the Revolution. The annual export for the twenty years prior to

A LOAD OF GARDEN TRUCK MOVING TO THE CITY

1817 amounted, on the average, to 90,000 bushels. At present in this country the relative yields of both crops are small as compared with the case elsewhere; this is probably because we get our nitrogenous food from meats and dairy products, of which we consume a large amount per capita. British India, Italy, Russia, and Spain are among the largest producers of legumes; in all these countries the bulk of the people is living on a much lower scale than is the working population of our country.

Other vegetables. Numerous other garden vegetables are the basis of local industries throughout the country, but we do not need to go into further detail. In a word, it may be said that

since the rest of the garden vegetables are rather bulky, and also perishable, there is not a very wide market for them, excepting for out-of-season distribution. Such products are the several varieties of garden truck; they are, for the most part, raised and consumed locally. Perhaps the sugar beet should receive especial mention. In Europe it has generally been cultivated and pulled out of the ground with exceeding care, lest it be bruised and thus spoiled; but in this country it is torn rudely from the ground, and then, depending upon our superior transportation system, we hurry it to the sugar-beet factory before it has time to decay. In Europe, also, the beet from which the juice has been pressed (beet-cake) is of considerable use as food for stall-fed cattle; whereas in this country, where cattle can be pastured or fed upon forage, it is of less importance. And the beet-sugar industry, as we shall later see, is of relatively small significance among us.

Fruits

Fruit-raising. In the early history of this country fruits, being regarded as luxuries, were scarcely used by the mass of the people. But attention came to be directed to them by the wealthy and cultured classes; and once started, fruit cultivation advanced apace, until at the present time fruit-raising has come to be an important industry throughout extensive areas of the country. In general, the fruits we raise are those of relatively low food value. It is not meant to say that fruits are not necessary and wholesome for the human body — quite the contrary; but one could scarcely live on apples, pears, grapes, peaches, oranges, and other of our American fruits. Their food value is not sufficient; they are largely "flavored water" as distinguished from such fruits as dates, figs, bananas, and other products of a warmer climate, which have a high food value and form a real "staff of life" to the people who raise them. But everyone likes fruit, and where the standard of living, as in this country, will allow of it, there is a place for a high development of production.

Apples. The apple is an Old World product, having existed in Europe, in both the wild and the cultivated form, since prehistoric times. In early colonial days it was difficult to bring young apple trees across the ocean; but there were no native trees, and so the fruit had to be grown almost exclusively from seeds, which meant that the trees were very long in coming to maturity. The

A ROCHESTER FRUIT NURSERY

introduction was, therefore, a slow process. Also the growing of trees from seed, and allowing them to mature without grafting, results in a poor quality of fruit — all of which facts may account for the circumstance that for nearly a century and a half apples were grown in this country almost exclusively for cider. Not until 1830 did our government begin to collect statistics concerning orchard products. However, there were some apple trees to be had even as early as 1640, for it seems that in that year five hundred young apple trees from a nursery in Massachusetts were exchanged for two hundred and fifty acres of land.

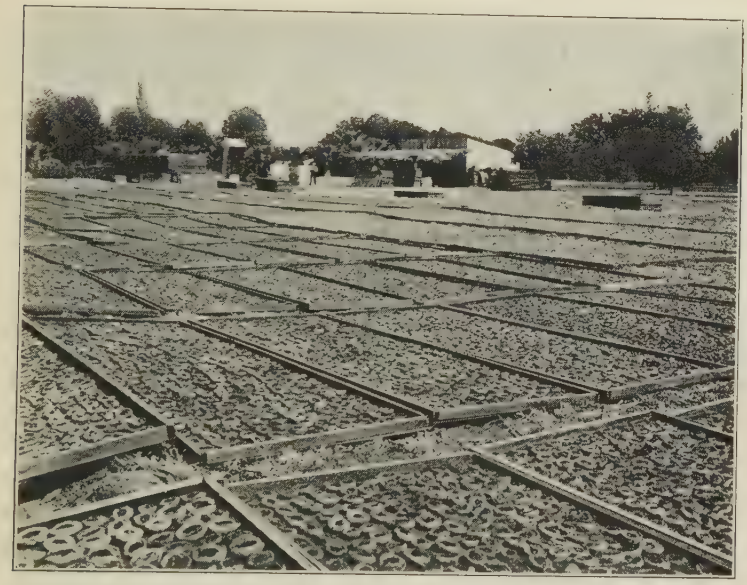
Apple-raising. Up to 1825 or so our apple orchards were confined chiefly to New England and Long Island, though there were some in New Jersey and New York. Toward the middle of the century there came about a marked improvement in the industry, due to the assistance of the government, the formation of horticultural societies, and other such encouragement. Nurseries became numerous, Rochester and other centers in New York State having taken up this specialty. Prizes were given for choice apples, and attention began to be given especially to winter varieties. Then, with the development of steam navigation across the Atlantic, we began the exportation of the fruit; by 1859 we were exporting 120,000 barrels from Boston alone. Varieties continued to improve and knowledge to be gathered as to the adaptability of this or that variety to a particular climate or soil. Then apple culture began to spread over the whole country.

The apple crop. At the present time the eastern part of the country is preëminent in apple-raising, though the Pacific states produce much superior fruit. Both in acreage and in annual value of product the apple far exceeds all other fruit crops. The states which lead in the number of apple trees of bearing age are those of the northeastern region, and New York is the chief apple-producing state.

Peaches. The peach is an Old World product, having been cultivated in China from very early times; thence it spread toward the west and for a long time has been planted in sheltered spots in Europe. It seems to have been rather commonly known in all the colonies previous to the Revolution.

Peach-raising. The peach tree is not so hardy as the apple, and climate is an important factor in its life and productivity. Severe winters and late frosts are likely to injure the buds and tender twigs. Again, this tree is cultivated in rather restricted areas, which are widely scattered over the country. Several of these may be mentioned: western New York; the region immediately east of Lake Michigan; that east of Chesapeake Bay, in Maryland and Delaware; Connecticut, especially upon the southern

slopes of the hills overlooking the valley of the Connecticut River; northwestern Arkansas and southwestern Missouri, along the southern slopes of the Ozarks; the state of Georgia, which is usually the largest peach producer of the Southeast, and which has the advantage of the Northern market, without competition from other regions, at a time when peaches from other sections



DRYING CALIFORNIA PEACHES

have not yet come into the market; and, finally, California, which shows climatic conditions favorable to the crop, and which normally produces more peaches than any other state in the Union. The California product is marketed widely in the cities of the East, and is sometimes sent abroad; but much of it is dried or canned, especially when the market for the raw fruit is unfavorable — as is true also in other peach areas.

Grapes. The grape has been cultivated from time immemorial. We do not know where it originated, but it was an Old

World product and early spread over Europe. It was carried from Great Britain to America in early colonial times. However, we were not entirely dependent on Europe for the vine; there are several varieties of native grape, notably the Catawba, which have been domesticated. The vine did not attain any great prominence until about the middle of the last century, when grape-growing,

A FLOURISHING VINEYARD

especially for wine, took a considerable start. Since that time the industry has grown to such proportions that the annual value of the grape crop now stands third among the fruits, being exceeded only by the apple and peach crops.

Grape-raising. There are two leading areas in the United States where grapes are grown extensively as a money crop: the eastern grape belt, in New York, between the eastern shores of Lakes Erie and Ontario and the central part of the state; and

the western belt, in California, where numerous Mediterranean varieties have been introduced. In the eastern belt American varieties lead; in the western, European varieties. California is by far the largest producer, followed by New York, Michigan, Ohio, Pennsylvania, and Missouri.

Oranges. The orange tree is an Old World product, having been grown in China and India since very early ages; its culture spread to America by way of Europe in recent times. The plant is essentially a tropical or subtropical one, and so can be grown successfully only in the warmer sections of the country. The sour orange was brought to Florida by the Spaniards in 1560; it ran wild, and until about 1880 large groves of wild oranges were to be found. The planting of orange groves for commercial purposes is of recent date; it is said that this was first done by some Northerners who went to Florida after the Civil War; and as late as 1880 the industry was still in its infancy. By 1890 orange-raising had made considerable progress, and since then has increased rapidly, especially in California. Oranges are on the market now every month in the year, for the crop does not come to maturity all at the same time. Unexpected frosts cause occasional great loss in the orange groves, amounting to millions of dollars. And along with the oranges the grapefruit is increasing in importance, although but a few years ago little or nothing was heard of it.

AN ORANGE GROVE IN FLORIDA

Other fruits. There are numerous other important fruit crops in this country, among them the strawberry, plum, pear, cherry, raspberry, and blackberry. These are very widely cultivated garden crops. We raise also lemons, dates, figs, and olives, whereas not long ago such of these as we used came from abroad. Owing to the variety of climate in this vast land, ranging from cold almost to tropical, there seems to be no limit to the possibilities of introduction of plants from other lands. However, unless we find some region particularly favorable for fruit, such as California, it may pay better, from a business standpoint, to bend our energies to the production of crops where we have a distinct natural advantage. This is the case with wheat and corn; we can do better to sell these and buy from abroad those products in the growing of which the people abroad have an advantage over us.

Canned fruits and vegetables. The canning industry based upon vegetables and fruits is a very extensive one in this country. We hear but little about the beginnings of it until near the middle of the last century; in 1846 fruit and vegetable canneries were in operation in New York, Boston, Baltimore, Newark, Portland, and Eastport (Maine). Those of Newark prepared the canned goods for Dr. Kane's arctic expedition. After 1850 canneries began to develop rapidly under the stimulus of an increasing demand for goods; they were introduced on the Pacific coast as early as 1856, and by 1866 they existed in most fruit-raising and vegetable-raising regions. The industry has had a phenomenal success. Likewise the drying of vegetables and fruits, which is another method of preserving them for use out of season, has become a prominent adjunct to the basic industry.

CHAPTER VII

SUGAR

Extent of sugar production. This is one of the most valuable products derived from the vegetable world. It is essential to the life of plants, many of which have food reserves stored away in the form of starch, which, after being converted into sugar, is used by the plants themselves. From several plants available for his use, man has learned to extract the sugar in tremendous quantities; the amount that figures in the world's commerce reaches twenty million tons annually, and in addition to this there are large quantities that do not figure at all in commercial statistics, being produced and consumed locally in countries of the Far East, in Africa, and in other places where it is impossible to keep track of production.

Sources of sugar. In the tropics sugar is often derived from the sweet juice of certain varieties of palm; in cooler regions, such as Canada and the United States, the sugar maple provides maple sugar. Honey was undoubtedly the first saccharine substance used by man; in using it he depended, of course, upon the collections made by bees from myriad plant sources. The "land of milk and honey" was, in Bible times, the land of luxury and plenty.

The love of luxuries. We wish here to pause for a moment to remark that human industry and commerce have never confined themselves to merely useful products. In the case of fruits, it is not the absolute food value that makes them attractive and in

demand; and the same thing is true of sugar and other commercial products later to be mentioned. They are wanted because they please the palate — because they respond to desires that are above and beyond mere existence. The savage would spend an amount of effort and care in getting a supply of honey to which nothing except dire hunger would have driven him had his object been merely common food. There never was any other form of human trade which surpassed the trade in spices in the eagerness and intensity with which it was pursued. Again and again it has been shown that luxuries will appeal to a people where necessities make little or no impression upon them. We shall have occasion to recall this fact, from time to time, as we go on.

CUTTING SUGAR CANE

Sugar as a luxury and a necessity. In the case of sugar, which is before us, we do not mean to say that it possesses no food value, — quite the contrary, — but it is the taste of sugar that made it popular. It was once a rare luxury; it was very scarce in Europe in the Middle Ages, and was even used as a medicine for lung and throat troubles. In those days a young man could please a young woman as much by securing her a lump of sugar as he could now by giving her a big box of candy, but he did not get off any cheaper. What was then a great and costly luxury has now become a cheap necessity; anyone who, in normal times,

cannot afford sugar is very poor indeed. Many such luxuries end by becoming necessities; it was with sugar as it is coming to be with floor coverings, hardwood floors, and the telephone. Nowadays we think we cannot get along without things which our ancestors never dreamed of having, and thus our life is constantly becoming more costly and more complicated. It is perhaps well for us that occasional pinches force us to drop back on the simpler things and to moderate somewhat our insistence upon what are really luxuries. Sugar, however, while it is a luxury when used with reckless profusion, and while it may, so used, do detriment to the body, has its distinct food value, as some others of the luxuries have not.

SUGAR BEETS

The cane and the beet. We return now to the common sources of commercial sugar. Of all the plants from which it is derivable, there are two which have stood the test better than the rest, namely, the sugar cane and the sugar beet. The former came into use long before the latter and deserves first mention.

Sugar cane. This is a large, grasslike plant which thrives best within or near the tropics, where it grows to a height of twenty feet. The stems are often a couple of inches in diameter and have a tough outer covering inclosing the sugar-containing tissue, which is soft. Sugar cane is another very anciently cultivated plant, of Asiatic origin. Its culture spread westward to Africa, Sicily, and southern Spain, and thence, early in the sixteenth

century, to Brazil. It was introduced into Haiti in 1520 and soon afterwards was to be found in Mexico.

Introduction of the cane. The Jesuits are said to have brought the cane to this country in 1751, when they introduced some plants from San Domingo into Louisiana; but little headway was made until 1794, when persecuted Frenchmen fled from San Domingo to Louisiana. Later on the culture extended somewhat into Texas and also to the east; in 1805 an enterprising Georgia planter secured and set out one hundred young canes, which rapidly propagated, the culture being extended into Florida and Alabama. But it soon appeared that the Louisiana plantations were by far the most productive, and the industry never got on very well elsewhere; in 1850 eleven twelfths of the country's yield of cane sugar and molasses was from Louisiana. This situation has not altered much in more recent years. In 1820 a hardier variety of cane was introduced from Java, which enabled the Louisiana plantations to be extended farther toward the north, with the result of much enlarging the area of production.

The cane-sugar crop. Cane-sugar cultivation in this country has had its ups and downs. Until 1843 our imports exceeded the domestic production, but in that year the latter more than doubled the former; in 1846, 1848, and 1854 more was produced here than was imported. Then came the Civil War, which ruined the industry: Louisiana produced 191,000 tons in 1862; 28,000 in 1864; 5000 in 1865. Not until 1871 did this state again reach 80,000 tons; but shortly thereafter a more prosperous period set in. The average yield from 1886 to 1891 was 163,000 tons, and the expansion continued until the greatest production on record — 398,000 tons — was reached in 1904–1905. At present the annual yield averages between 200,000 and 325,000 tons for Louisiana, with a few thousand tons for all other districts in the United States proper. Porto Rico, Hawaii, and the Philippines, however, produce much cane sugar.

Conditions of cane-sugar production. It is said that the best climate for raising sugar cane is one whose average temperature

is about 80° F. and where the rainfall is sixty inches or more a year. This is about three times the annual rainfall necessary for successful farming of cereal and vegetable crops. Sugar-cane culture belongs to the tropics and subtropics and can never be more than a local industry in this country. It is in British India, and especially in the two islands of Java and Cuba, that its greatest success is assured. Cuba produces considerably more than half of the whole amount for the continent of North America.

A BEET-SUGAR FACTORY

Beet sugar. Despite the fact that the derivation of sugar from the beet is a modern achievement, about a fourth of the world's present crop of commercial sugar is thus derived. Not until the middle of the last century did the industry rise into any prominence. But its advent has wrought far-reaching changes in the whole sugar industry, which have reacted, in turn, upon the economic life of millions of people. Only a short time ago sugar, as we have seen, was a luxury; to-day it is a staple article of consumption in most parts of the civilized world; and it is largely the expansion of sugar-producing from its previous tropical fields that has allowed this change to come about.

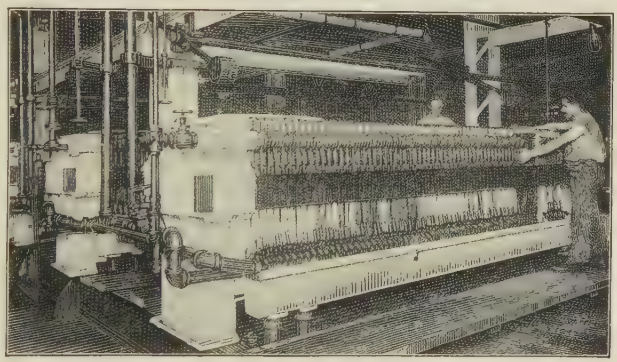
Sugar-beet raising. The sugar beet is a variety of the common beet, and grows best in the climatic environment of north temperate latitudes; a greater weight of roots per acre can be raised in warmer regions, but they are not so rich in sugar. As regards soil, wherever ordinary farm crops — wheat, maize, or potatoes — will grow, there the sugar beet will get on if the drainage is good.

Beginnings of the beet-sugar industry. Toward the latter part of the eighteenth century it was shown, in Germany, that sugar could be obtained from beets. The first Napoleon did much to encourage the industry in France, especially in 1812, when the French were cut off by blockade from a cane-sugar supply; at one time he caused the sum of a million francs to be appropriated to its encouragement. But after the fall of the emperor production almost died out. By 1820 it was reviving again, and has since developed swiftly and extensively, until it is very large. In this country experiments began as early as 1838, one David Child, of Northampton, Massachusetts, having produced 1300 pounds of sugar in that year. In 1863 the Gennert Brothers, of Chatsworth, Illinois, went into the business on a 2400-acre tract; they and a like establishment in Freeport consolidated in 1870 and produced in that year 200,000 pounds of sugar at moderate cost. Other experiments were made in different places, and finally, about 1890, the production of this variety of sugar was firmly established; up to that year only three factories had been established in the country, and they were all of small capacity.

The beet-sugar crop. Our present production of beet sugar is over 900,000 tons, out of a world's total commercial production of somewhat less than 5,000,000 tons. Our states of largest yield are Colorado, California, Michigan, Utah, and Nebraska. As yet, however, Europe has a great preponderance in the beet-sugar industry; European countries began earlier, and their governments have helped the industry by granting subsidies and liberal bounties.

The Manufacture of Sugar

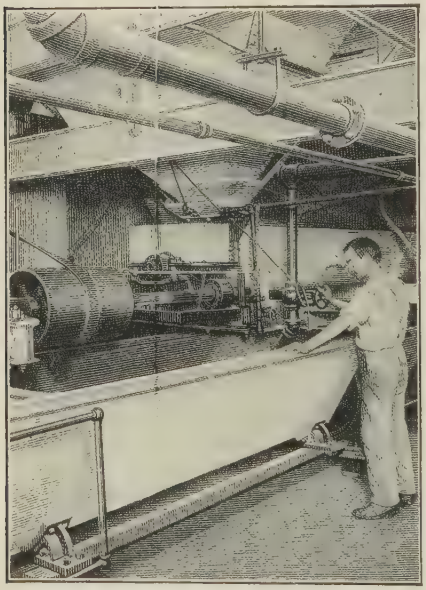
Manufacture from the sugar cane. The first method of getting the sweet juice from the cane was the natural one of chewing and sucking; the teeth were the mill. Then came the hand mill, which had two rollers, set upright and about an inch apart. Such machines, with wooden or iron rollers, were wasteful, for they extracted only about 25 to 40 per cent of the juice. Later on, steam power was introduced, the rollers were increased in number and size, and finally in the modern mill the producer manages to extract 80 to 90 per cent of the sweet fluid. This is an unattractive-looking, dark-greenish substance with a pleasant odor. It contains impurities in the form of dirt, pieces of the plant, and various other foreign matters dissolved in the juice, all of which must be removed. The older method of getting the sugar out was known as the "open-kettle" process, for the juice had to be boiled. It was treated chemically also in some of the processes, which helped to bring to the surface a scum that could be taken off. The sirup was finally brought to a proper condition for granulation, which was a critical point in the procedure; later it was led off into coolers for granulation; and then the raw sugar had to be refined.



FILTER PRESSES IN SUGAR MANUFACTURE

The vacuum pan. Evaporation in open pans was slow and expensive. The most important improvement in turning the juice into sugar was made when it was discovered that the hot vapor

rising from a vessel of boiling cane-juice could be used to evaporate the water from a second receptacle. The idea was put into practice as early as 1830, but the real credit of the invention belongs to Norbert Rilleaux, of Louisiana. After much expense and labor had been undergone in working out the details of the invention, Rilleaux's apparatus was put into operation in 1845. It did not work so very well at first, but the tests of 1846 proved successful and laid the foundation for the elaborate system of evaporation now in use wherever capital and intelligence have combined to carry on the industry. By the middle of the century there were multiple evaporators, consisting of a series of pans, by the use of which up to 85 per cent of the water contained in the liquor is removed by steam.



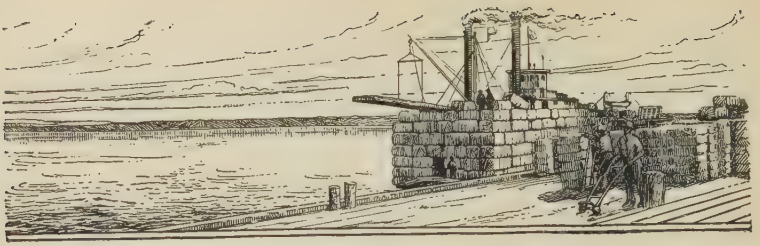
MINGLING SUGAR WITH FLUID BEFORE WASHING

Additional processes. As early as 1834 bone black was introduced as a means of clarifying the sirup, and a nearly chemically pure white sugar was the result; this was then shaped into loaves by the use of molds. Sugar is now treated with lime, phosphoric acid, and soda for removing the last impurities, and is bleached by sulphur dioxide. It is evaporated in a last pan, called "strike pan," to the point of crystallization. The molasses is separated from the sugar by whirling it in centrifugal machines.

Manufacture from the sugar beet. The beets have first to be thoroughly cleaned; following this they are dried and weighed

in scales which automatically dump their load when the desired weight is reached. The roots are then cut up for removal of the juice; they were formerly reduced to pulp by pressure, but the slicing process has been found superior.

The removal of impurities. The juice is extracted by water contact, which causes an exchange of the sugar juice within the plant for the water cells without. Raw-beet juice cannot be evaporated, for it contains certain foreign substances which cause it to become thick like gelatin if subjected to heat. These impurities are removed by adding milk of lime to the juice, which is then heated, carbon dioxide being passed through the limed solution. The result is the removal of most of the impurities, though certain other chemical processes also must be employed before the standard purity is attained. The evaporation is then accomplished by the use of the vacuum pan. The process of sugar manufacture is very complicated, but these are the main facts.



CHAPTER VIII

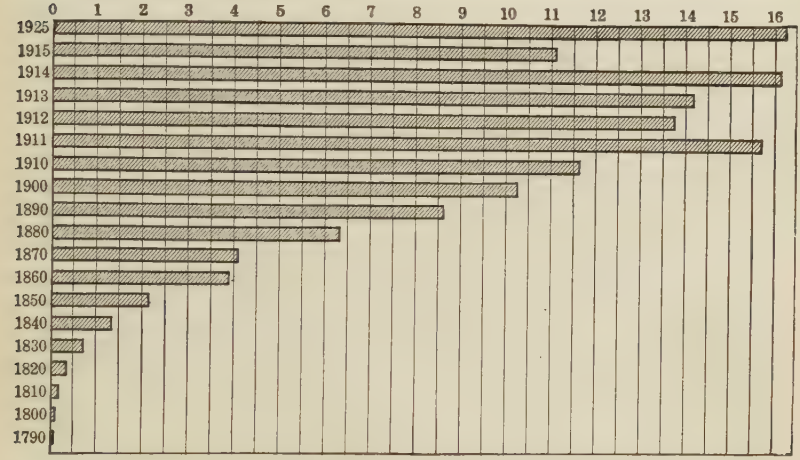
COTTON

Fibers. The agricultural products hitherto described have been chiefly food products; practically all of them have been produced to be taken into the human or animal body. But now we come to a product whose fiber is sought, above all, as a material for clothing. It represents by far the most important material used by man as a body covering.

Conditions of cotton-raising. Cotton, except one or two types, is not native to the New World, but the early discoverers and explorers found the Indians engaged in raising cotton from New Mexico to Brazil, north and south, and from the West Indies to Peru, east and west. The plant grows in widely scattered regions of the world, between the latitudes of 40° north and 30° south. It is a warm-climate crop, needing plenty of sunshine, copious rainfall during the growing season, and, for the best yield, a soil containing silty clay. If the pods open too soon it is bad for the crop; on the other hand, frosts are a great danger.

Early cotton-raising. The settlers of this country planted cotton as early as 1621, and it was under rather careful cultivation in South Carolina by 1666; it appeared in Maryland gardens in 1739 and was tried in New Jersey shortly before the Revolution. Owing, however, to the difficulty of separating the cotton fiber from the seed, and the slowness of hand-manufacturing, there was little demand for the raw product, either in this country or abroad, previous to the Revolution.

Importance of the industry. From such humble beginnings has risen an enormous industry. In 1790 our cotton production was 4000 bales; in 1850 it was nearly 2,300,000; in 1890, over 8,500,000. The present yield fluctuates around 12,000,000 bales. The crop of 1926 (18,000,000 bales) was very large — the largest ever grown. Cotton has come to replace other fibers



COTTON PRODUCTION IN THE UNITED STATES SINCE 1790 (IN MILLIONS OF 500-POUND BALES)

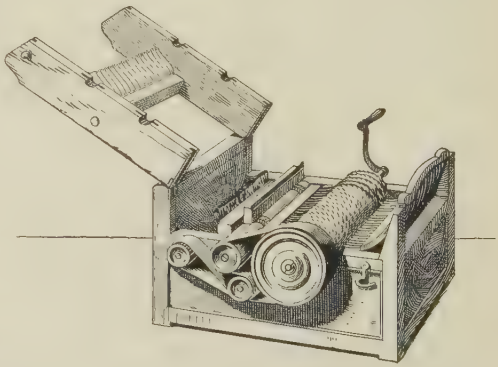
After diagram in *Statistical Atlas of the United States*

as the most common or widely used textile for the manufacture of clothing. It is a characteristic American product, just as spices are characteristic of the eastern world; we raise, in an average year, about three fifths of the world's raw cotton. Cotton has been an outstanding factor in our national history and development: it has exerted a strong influence upon our political, industrial, and commercial life; it has had a most important bearing upon the labor question; it has affected our diplomatic relations with other countries; and it has been for decades the dominant source of our purchasing power abroad.

Conditions favoring the industry. What brought cotton to its dominant position was a combination of favoring circumstances.

ELI WHITNEY

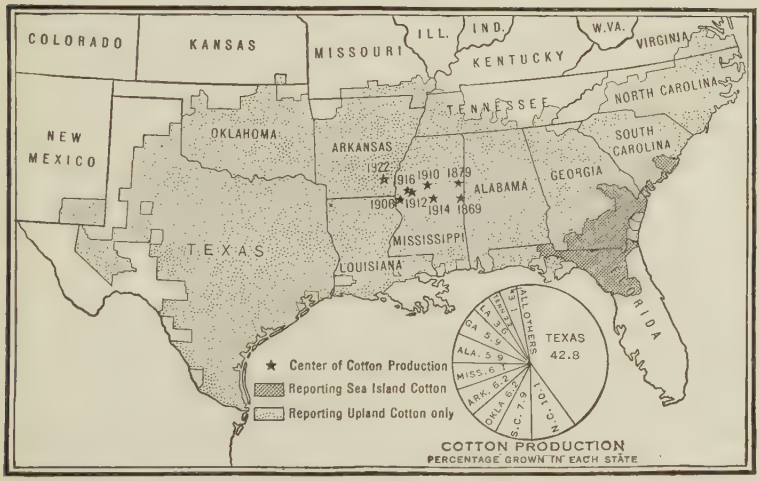
In England cotton was for a long time used as an adulterant for linen, but it was not thought that cloth could be made from it alone. Then came the invention of machines (improved loom, water frame, spinning jenny, power loom, steam engine), enabling the spinning and weaving of cotton to be readily accomplished. And at length came the Whitney cotton gin, which so far surpassed all previous types of gin that it did away with the arduous labor of separating the cotton fiber from the seed, and gave cotton at once a great lead over other fibers in utility and cheapness. The invention was made by Eli Whitney, of New Haven, Connecticut, in 1792. Furthermore, the expansion of the country toward the southwest was favorable to the advance of cotton-raising; from the original centers it extended into Alabama, Kentucky, and Tennessee. Then the Louisiana Purchase gave us Louisiana, Arkansas, and other territory beyond the Mississippi, and the state of Mississippi began to develop rapidly. Florida was annexed in 1820, and Texas acquired, at length, in 1845. And all this time the foreign demand was on



WHITNEY'S COTTON GIN

the steady increase. Such facts explain in large part the rapidity and extent of the growth of cotton culture.

Effect of the Civil War. The Civil War practically stopped production for four years; and the interest of the outside world in cotton was so great as almost to lead to European intervention in favor of the South. Production was attempted in the North, but the climate made it unsuccessful; the plants flourished well



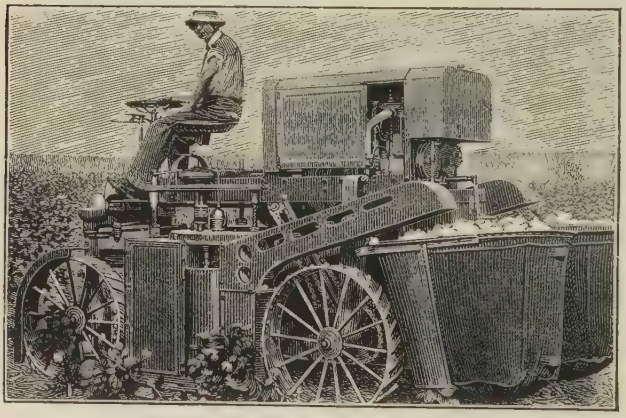
COTTON-PRODUCING AREAS OF THE UNITED STATES

After data in bulletins of the United States Bureau of the Census

enough, but the balls containing the fiber would not mature. As soon as the war was over we again took our place as the world's chief producer of cotton; a production of nearly 4,500,000 bales, in 1859, had fallen almost to zero, and then, by 1869, had recovered to about 2,750,000; in 1879 the output was over 5,200,000.

Varieties of cotton. The so-called "cotton belt" of our country is about 1450 miles long, from east to west, and about 500 miles wide, from north to south, and includes all the southeastern states from the North Carolina coast through Texas. Within this belt

there are two kinds of cotton grown: the "sea-island" and the "American upland." The former is the best type, from the standpoint of trade, to be found in the world; its fiber is longer and finer than that of any other variety. This plant was native to the New World and may have been the one known to the Indians before the Discovery. The very best of this variety is grown on the sea islands along the coast of South Carolina, but a large part of it is found on the mainland of Georgia and Florida. Only a little — under 4000 bales — is produced; and it is so highly prized that a large part of the crop is exported. The upland cotton is the variety most commonly grown in this country, and is thus most largely represented in commerce; it is not native, but is supposed to have been brought here from Asia through Europe. The fiber is of medium length, and shorter and coarser than that of sea-island.

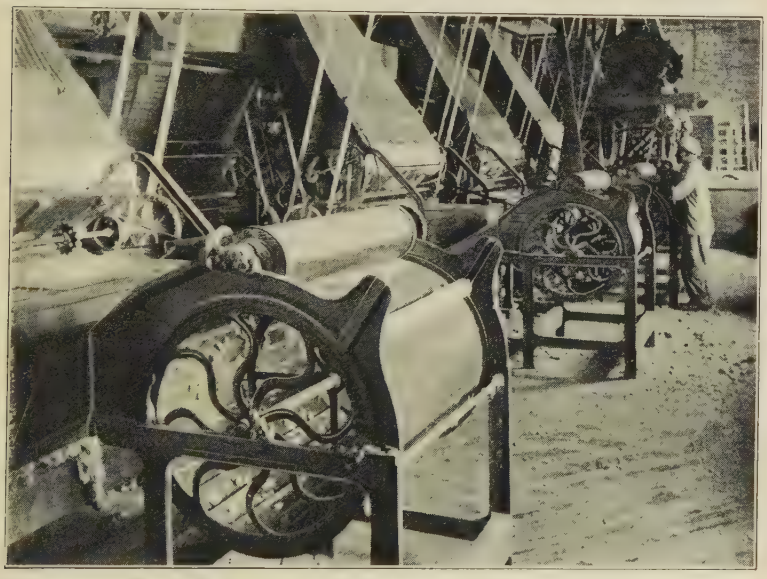


A COTTON-PICKING MACHINE

Nature of the plant. The cotton plant is cultivated as an annual; that is, the seed is sown every year, and when the plant has produced its full yield of pods it is abandoned. It is a low shrub, that develops a pod, or boll, containing the seeds (about the size of small peas) and a quantity of "lint," which clings tightly to the seeds, the whole bursting, at maturity, out of the boll. The fiber is from half an inch to two and a half inches in length, and it takes about seventy-five medium-sized bolls to make a

pound of raw cotton. The fiber is of such construction that its strands cling together and do not slip on one another; this enables them to be twisted into thread, and finally woven into cloth, even though they are short.

Harvesting. The harvesting of the crop has been done up to the present time almost wholly by hand; the cotton-picking season



COTTON GINS IN AN UP-TO-DATE COTTON MILL

was one of the busiest times under the old slave system, and it is still a period that calls for much hand labor. The bolls do not all ripen at the same time, and a machine that will pick off the ripe bolls may so injure the plant that the unripe ones may not mature properly. Cotton is usually picked four times a season, the largest yield coming from the second picking, and the smallest from the last. Though cotton-picking is unskilled labor, and cheap, yet this item is the costliest in cotton production. An average day's work for one person would be the picking of a

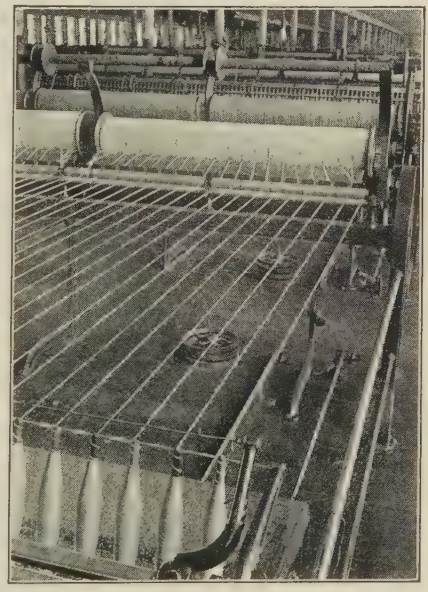
hundred pounds; it would thus take three million people five weeks to gather a big crop.

Preparation for the market. Nothing can be done with the fiber until it is separated from the seeds. Here is where its manufacture really begins. Superseding hand labor here, the cotton gin rapidly and efficiently combs out the seeds; then the fiber is worked out into sheets, and in that form goes to the press. The seed was at first thrown away, but, as will presently be seen, it is now a valuable by-product. The bales were formerly made by trampling the fibers in a box; but machinery now bales the cotton much more compactly, bagging it and inclosing it in iron bands without human assistance. The bales weigh about five hundred pounds apiece.

SPINNING COTTON IN THE OLDEN DAYS

Localities of cotton-manufacture. The industry calls for advancing transportation facilities, for the bales must be carried to the factories. And the chief factory region is still in New England; only recently has Southern cotton-manufacturing made a serious bid for first place. New England has possessed certain local advantages for manufacture: water supply, nearness to materials and fuel, nearness to markets, favorable climate, a good supply of efficient labor, plenty of capital, and, of course, the momentum of an early start. Massachusetts is still the leading cotton-manufacturing state, but in recent years the Carolinas and Georgia have come into prominence.

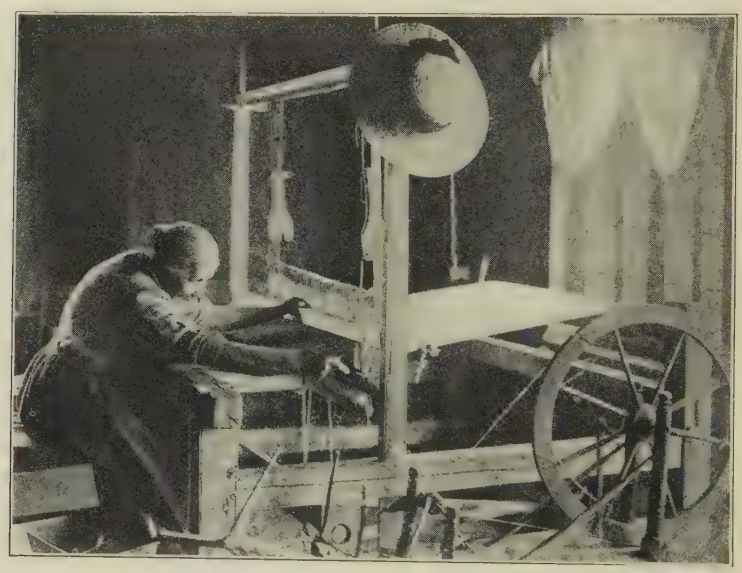
Spinning. The immediate product of the cotton fiber is thread, and the thread has to be spun. This was a familiar process in very ancient times, and consisted, at the outset, of merely rolling the fibers by hand; then the spindle, a sort of top-like instrument, was invented. Much more modern is the spinning wheel, of which examples may be seen in any collection of colonial instruments. This wheel was used chiefly for wool and flax, but it is an important link in the chain leading to all modern spinning and weaving devices. Then came the spinning jenny, which enabled a number of threads to be spun by one operator at the same time; and the water frame (so called because run by water power) and the mule, by which stronger threads could be spun and the process otherwise improved. The detailed description of these various inventions can be found in standard encyclopedias. To-day the spinning mule has more than a thousand spindles, all of which are operated by one person.



A MODERN SPINNING MACHINE

Weaving. But the threads are of comparatively little avail until they are woven into a fabric. Weaving has been long known among even the most backward peoples, who made baskets by interlacing reeds or withes; then fiber threads were employed and a loose-textured cloth manufactured. The instrument here employed was the loom, in combination with the shuttle. Threads were hung from a cross-piece of wood, or a branch, and other threads passed over and under them, as in the stringing of a tennis

racket; the shuttle carried the end of the cross-thread. These instruments are the basis of modern weaving machines; first came the application of foot power, and then the power loom, patented in 1785. It is impossible in a book of this kind to give even an approximate notion of the working of these more complicated inventions — again we refer to the standard encyclopedias.



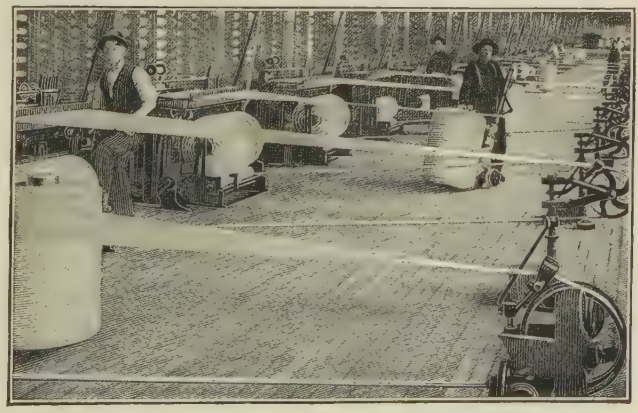
AN OLD-FASHIONED LOOM

The factory system. Now it is to be noted that the earlier spindles and looms were used in the home, but the developed machines, costly as they were, demanded not only more room than the cottage could spare but also much capital. They naturally led to the development of factory industry to replace that of the home. With these inventions fewer workers could turn out a much larger product in a much shorter time, and the result was a great wave of misery for people who had hitherto gotten along pretty well by the work of their hands. Many such cottage workmen could not live in the old countries under the new conditions,

and this was one of the reasons for the immigration of such a fine and industrious element of population into the United States. The period is that of the Industrial Revolution, brought about chiefly by the inventions, which we have already told of, in the textile manufacture.

THE INTERMEDIATE ROVING FRAME, WHERE SPINDLES TAKE OFF, DOUBLE, AND TWIST AGAIN THE ROLL, OR ROPE

Mercerizing. Several other important processes of great moment are also connected with the manufacture of cloth; for example, mercerizing. This process, as applied to cotton, consists in treating the yarns or woven goods with caustic soda and sulphuric acid, the result being to give the surface of the material a smoother finish and also a luster like that of silk. The process succeeds best with sea-island fiber, since this is naturally somewhat



BEAMING THE WARP TO BE WASHED AND DYED

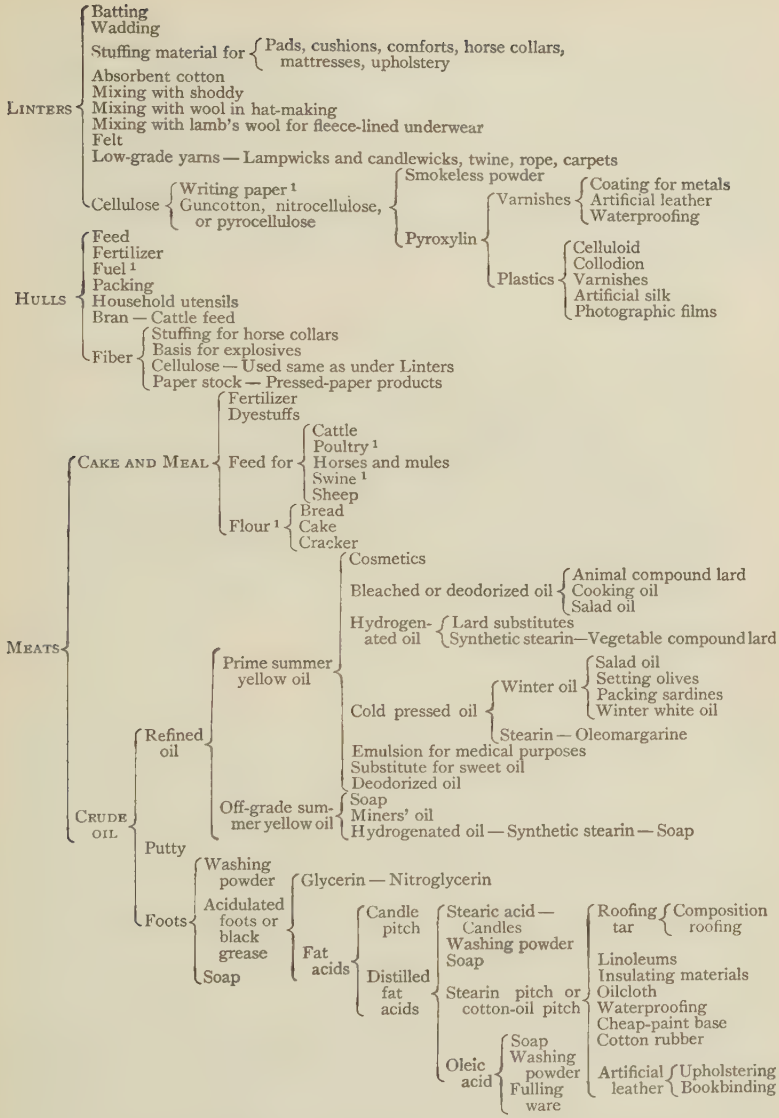
silky. Of course if cotton can be made to look like silk, it is a more valuable fabric; it can be used also to adulterate silk.

Dyeing and finishing. The dyeing and finishing of cotton goods is also very important; more than half of the cottons woven in this country are colored, by dyeing or printing, before they are used. Some of the commonest modern dyes are products of coal tar, a thick, dark liquid that gathers in gas pipes when the gas is being taken from the coal; from it some most remarkable results have been reached in the production of dyes of several colors. The dyeing is done sometimes before the spinning takes place and sometimes after the weaving is done; to make it permanent a mordant, or "biter," is used to fix, or "bite in," the color. Such a material is alum. In general the vegetable dyes are less likely to fade than the mineral ones.

Cottonseed

Uses of the seed. When the cottonseed, once separated from the fiber, ceased simply to be thrown away, it was employed to some extent as fertilizer; but all this is now changed, for the seed has been discovered to have many uses formerly unknown. For example, it yields a valuable oil. The Chinese knew this a long time ago and used the oil for illuminating purposes. In the western world it was the English who first made oil from cottonseed, and in this country the industry dates from about 1870.

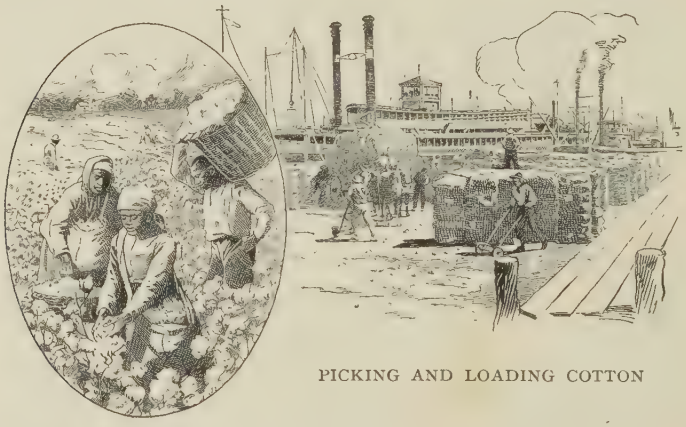
Treatment of the seed. The seed is first ginned over again to take off the fuzz, or "linters," still sticking to the seed; then the hulls are removed and the seed crushed under heavy pressure. The oil is used in cookery, in soap-making, and to mix with other oils. And this is not all that is gotten from the seed. The cake left after pressing is dried and pulverized, forming cottonseed meal, which is used to feed stock and also as fertilizer. Cottonseed meal constitutes almost as great a value in this country as the oil. Even the husks of the seed are useful; formerly they were burned and the ashes used as fertilizer, but now they are mixed with the meal to make stock feed.



PRODUCTS AND USES OF COTTONSEED

[1] Possible uses to which small quantities only are devoted.

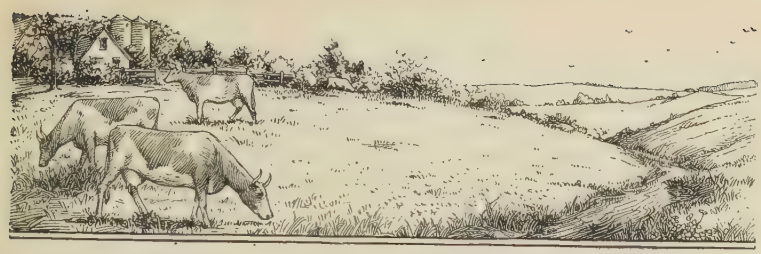
By-products. In all industries there is much waste at the outset. It is not then seen to be waste, because there is no known use for what is discarded. But as time goes on and the competition of industries becomes keener, the processes are studied more and more minutely and every effort is made to save; for the saving of apparently useless materials often makes the difference between the successful plant and the one which goes



PICKING AND LOADING COTTON

under. We reproduce on page 103, from a recent *Census Bulletin*, a chart of the products and uses of cottonseed, to give the reader some idea of the saving that has been accomplished from what was once a waste product — in fact, a public nuisance, for the rotting seed, forming as it did a mass of decaying matter, was sometimes that.

The cotton cities. All of our great industries, including cotton culture, have contributed strongly to the development of cities and transportation interests; as Chicago centers upon the grain business and Pittsburgh on steel and iron, so have Charleston, Savannah, Galveston, Vicksburg, and Memphis centered upon the cotton industry. This industry has practically made these Southern towns, as the other industries mentioned have made the Northern ones, and it has done this very largely by forcing a development of transportation.



PART III. ANIMAL INDUSTRIES

CHAPTER IX

CATTLE

Killing the animals. Domestic animals represent one of the great conquests of man over nature. When all animals were wild, they meant to man only what they meant to one another — a source of danger, a source of food, or a competition for food that both parties wanted. In any case the animals represented an unfriendly, when it was not a hostile, element in man's environment. A large part of man's activity has been expended in killing the animals — sometimes simply for his own comfort in being rid of them, as in the case of the lion or the mosquito, and again for the sake of feeding on their bodies. That he has been very successful in this enterprise is a matter of general knowledge, though there are still certain minute living things that he cannot yet eradicate, such as the microscopic germs of disease.

Domestication. But man did not confine himself to utilization of the dead bodies of the animals; he learned, after a while, to capture them alive and to tame them. Then they bred in captivity, and he surrounded himself with numbers of them which he had domesticated and upon which he could rely for a constant supply of food. This domestication of animals was one of the greatest of human exploits, for it made life much less subject to chance; food-getting in the hunt was always more or less

precarious, but now man could get from his animals not only food but articles for clothing and shelter. And he learned, besides, to employ the special qualities of his animals — the scent of the dog, the strength of the ox, the swiftness of the horse — to assist him in the struggle for existence. Possessing them, he became really as keen as the dog, as strong as the ox, as swift as the horse; he appropriated their qualities to himself and lived his life the more safely and successfully thereby.

Breeding. And as he bred his beasts he selected for preservation those which he most valued. These were the ones which produced the next generation, and that next generation kept and even increased through inheritance the desirable qualities of the parents. Man became able to mold by his action the qualities of his domestic animals; he bred them for the things which he wanted of them, and animal-breeding became a science and an art that produced the most astonishing results in adapting the animals to man's purposes. Some of the domestic animals have been bred, in the course of ages, to be so different from the wild stock from which they came that we cannot be sure as to just what that stock was. The same is true, of course, in regard to domesticated plants, but it is more striking, perhaps, in the case of animals; for, though animals were more plainly hostile to man, yet they have been pulled over, as it were, from the ranks of his enemies to fight on his side in the battle of life.

Wealth in domesticated animals. The wealth of a country in these days, long after the beginnings which we have sketched, lies in good part in its domestic animals. They still furnish the materials for food, clothing, and shelter, and they have not ceased to be useful in assisting man in his labors. In our modern civilization the most important domestic animals are cattle, horses, sheep, swine, and goats. These were all domesticated ages ago, and the form in which we know them is, as we have said, quite altered from that shown by their ancestors when first they became attached to man's service. In a very real sense they have been made what man ranked them to be.

Origin of the best breeds. It takes a high civilization to produce a highly bred domestic animal; savages have not the knowledge, skill, or means for producing and holding a special and superior breed. To keep up a good breed, it is necessary to prevent it from crossing with inferior or wild stocks; there must be inclosures, which the savage seldom has. Hence the best domestic breeds have come from regions of old and advanced civilization; that is, from the Old World, and chiefly from those parts of it where human civilization began — namely, in southern Asia, southeastern Europe, and northeastern Africa. This explains in part why the Americas have contributed no important domestic animal to the world.

Few American breeds. But America seems also to have been singularly lacking in animals suitable for domestication. The Indians domesticated the llama and alpaca, but these were never of more than local importance. The bison was not domesticated; probably the hunting was so plentiful that there was no stimulus toward domestication. But when the Old World animals were once introduced, they were found to be well adapted to our climate, vegetation, and environment in general; the horse, for example, originally brought by the Spanish, ran wild in great herds over the Western plains. At the present time the United States form one of three main sources of supply for animal food-products, the other two being Argentina and Australasia.

Cattle

The beginnings of American cattle-raising. Bulls and cows were first brought to America by Columbus in 1493; the Spanish breeds were introduced into Mexico about 1525 and form the basis of the Texan stock. From these were probably derived the cattle possessed by the Indians at the end of the seventeenth century. Portuguese cattle were introduced into Newfoundland in 1553, and the French brought Norman cattle into Canada a little later on. The various colonists from the northern European

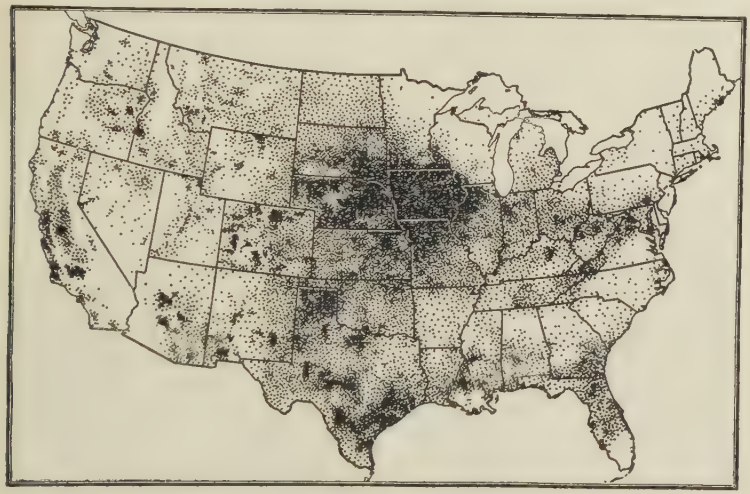
countries introduced their own breeds. From these various stocks descended the great numbers of cattle found later in the United States. In the early days, and for a long period, cattle were valued chiefly for their hides, and breeding for the purpose of keeping stock pure was not much attended to until early in the nineteenth century. Oxen were used for heavy labors, for in colonial days horses were far too costly for farm work. One or two cows were kept for their dairy products, which were chiefly for home use, though if there was a surplus it could be disposed of at the village store.

The demand for meat. It was with the concentration of population in towns and cities that there developed a demand for cattle as a meat supply. In New York, in 1678, we are told, the average number slaughtered yearly was four hundred, and in 1694, four thousand. In 1680 the price of beef was about two and a half pence a pound.

Neglect of cattle. For the first half-century of our colonial period the cattle, especially in the winter, were much neglected; shelter was not provided, or, if it was, it afforded little protection. Cows were not milked in the winter, for there was a prevalent belief that winter-milking would kill them. Little or no food was stored for cattle; even in winter they browsed on what they could find in the fields and along the roads. Naturally they became very thin and poor in the cold season, and many of them died of hunger and exposure. In general, they were much smaller than our present stock. The horses were worked hard and underfed; after a heavy day's work they were simply turned into poor pasture, and the same sort of neglect was the portion of the sheep and swine.

Westward movement of the industry. Cattle-raising is a business characteristic of frontiers, and as the frontier in this country moved westward, the cattle industry moved with it. At the same time the growth of population in the East created a demand for meat products; the first fattened or stall-fed cattle that ever crossed the Alleghenies journeyed on the hoof from Ohio to

Baltimore in the spring of 1805. This was the only way to get cattle from the frontier over the mountains to the region of demand. Beginning early in the century, then, there developed a profitable industry in the fattening of cattle on corn during the winter, the animals being driven to the East when the spring came. Ohio and its neighboring states first developed this enterprise. Then, early in the second quarter of the century, there



DISTRIBUTION OF CATTLE (OTHER THAN MILCH COWS)

After map from United States Department of Agriculture

arose an interest in improving the breeds of live stock; the exhibits of cattle at county fairs stimulated an interest in this matter. The industry began to take on a modern tinge and to show its possibilities; improvement brought prosperity and profits, and success stimulated to further improvement.

The cattle states. The industry continued to follow the frontier. As late as 1850 the states having the greatest number of cattle lay, with one exception (Ohio), along the Atlantic seaboard; the states having over one million cattle were, in order, New York, Ohio, Pennsylvania, Georgia, and Florida. Fifty years later there

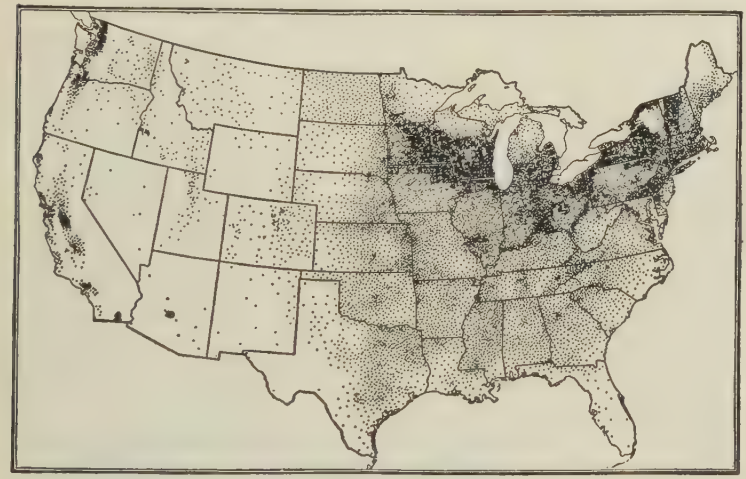
were eighteen states and territories which had at least a million cattle each, but by this time the great cattle states were in the West, with Texas, Iowa, Kansas, and Nebraska in the lead. The Eastern states, which had formerly contained extensive areas suitable for grazing, had been filling up with population, and these sections became too valuable for the former purpose. Then, also, grazing on the large scale called for even more extensive areas

A "ROUND-UP" ON A WESTERN RANCH

of pasture. The very best environment for stock-raising on the large scale is, for this country, the High Plains region, just east of the foothills of the Rocky Mountains. Not only are the choicest grazing grounds here, but because of deficiency of rainfall for farming the agriculturist puts up but small competition; rainfall insufficient for farming, however, may be quite adequate for grazing.

Cowboys and farmers. In recent years the development of irrigation in the semi-arid regions of the West is making some impression on the cattle-raising industry. The encroachment of the farmer has often resulted in a hot set-to between him and

the cowboy — between the "fence men" and the "no-fence men." The cowboys resented anything, like a fence, that might limit freedom of motion and of utilization of pasture; and they used to cut the wire fences and otherwise hamper the farmer in his business. It is the old fact again that as soon as an area ceases to be frontier, with characteristic frontier conditions, then it is no longer suitable for a frontier occupation, such as grazing.



DISTRIBUTION OF MILCH COWS IN THE UNITED STATES

After map from United States Department of Agriculture

However, from some of these regions where irrigation and planting are in vogue beef is still shipped out in large quantities; this beef production is due in good part to the alfalfa, an immigrant crop well suited to dry regions, several harvests of which can be cut in a season. During the winter months, and in periods of great drought, alfalfa is the staple food of the cattle.

Progress of the industry. The development of cattle-raising in this country has shown rapid progress in the last half-century. Of all our domestic animals cattle form the largest item; but their value is considerably less than that of the crops raised on our farms. In a recent year the states having the greatest number

of milch cows were Wisconsin, New York, Iowa, and Minnesota; those having the largest number of other cattle were Texas, Iowa, Nebraska, and Kansas. Many of the states in the High Plains region have great numbers of cattle other than milch cows. The latter are conspicuous by their absence, because these states are far remote from the great milk-consuming centers of population.

Refrigeration. The marketing of fresh beef in places remote from the locations of raising and slaughtering the animals, to say

ICING REFRIGERATOR CARS

nothing of an export trade in this commodity, has had, in its development, a strong bearing upon our cattle-raising industry. These enterprises were possible only with the progress of refrigeration, which has been practiced since about 1875. The early refrigerator car was an adaptation of the freight car; double floors, roofs, and sides were provided, and the intervening spaces were packed with sawdust. The car had a large ice-box, the water from which, as from a common refrigerator, dripped out through a hole in the bottom of the car. The first shipment of refrigerated fresh beef forwarded under such conditions was made from

Chicago to Jersey City in the seventies. Naturally the sale of beef in distant markets greatly stimulated the production of cattle raised for meat.

Export of fresh beef. Then came the export of fresh beef across the ocean. In 1875 a New York merchant shipped a few carcasses to Liverpool by steamer, the meat being kept cool by hand-operated fans. The project was successful and was repeated later in that year on a larger scale, the fans being operated by steam; and presently the shipments, while still very small as compared with later ones, had increased markedly in amount. Since these beginnings the industry has steadily progressed, and improved methods have been introduced to keep the meat in good condition. An idea of the sudden growth of the industry can be gained from the fact that while in October, 1875, our exports of fresh beef totaled only a few thousand pounds, for March, 1877, they amounted to over 6,700,000 pounds, and for the whole year 1877 they exceeded over 55,000,000 pounds.

Export of live stock. About the time that fresh beef began to be exported there commenced also the foreign shipment of live stock. This industry continues to-day on a large scale, for British and other European importers prefer to slaughter the animals themselves where practicable. Accordingly we find numerous steamers leaving our coastal cities loaded with live stock destined mainly for Great Britain. It is rather more expensive to ship the cattle alive than to send the beef, for some cattle die on the way, others fall off in weight, and all of them have to be fed during progress to the coast and on the voyage.

Meat packing. A further powerful stimulus to cattle-raising has been the tremendous expansion of the meat-packing industry. Time was when thousands of cattle were slaughtered each year for their hides, tallow, and horns, their flesh being discarded because there was no method of preserving the meat except by drying, or "jerking." About 1880 was perfected the process of hermetically sealing meat in tin cans, which enabled it to be kept for a long period. Then arose great packing plants in places

where cattle were fattened and slaughtered. The earlier packing plants were in Chicago and Cincinnati, but later Omaha, Kansas City, and other centers developed and became important. In connection with meat-packing, what we have said in regard to cottonseed manufacture should be recalled. With cattle also we find the development of processes for utilizing every scrap of useful material in the animal carcasses, and also the combination of a number of contributory industries around a main plant.

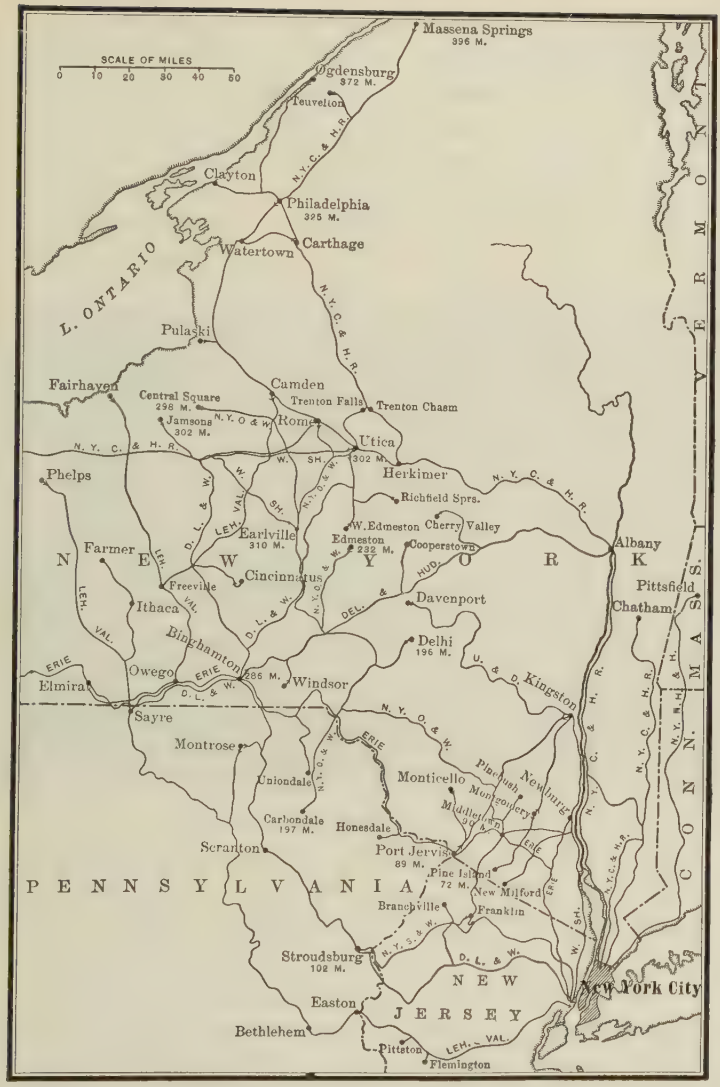
A STAGE IN MILK DISTRIBUTION

The milk has been shipped from the country to the city in refrigerator cars, and this team hauls it to the distributing points in the city

Dairy Products

Development of the dairy industry. The production of milk for food is an important branch of the cattle industry. We have seen that the colonial farmers generally kept cows, and that their butter and cheese were homemade. But as population increased, the villages had to be supplied by neighboring farmers who peddled the milk every day; and the business has grown and developed

FILLING CREAM BOTTLES BY HAND



SOURCES OF THE MILK SUPPLY OF NEW YORK CITY

as city populations have had to be supplied from the surrounding country. The map will give some idea of the extent to which a big city is always drawing upon the country. Also the means of transportation has altered; the small milk wagon has given way to the automobile and to the milk trains which daily rush, in the early morning hours, into the large cities.

Modern sanitary methods. And the dairy industry has been much complicated by the modern demands for cleanliness and

BOTTLING MILK IN A SANITARY DAIRY

sanitation. Milk easily becomes impure and soon spoils, so that neatness and speed are essential if there is to be no disease coming from the milk supply. In the best of modern dairies the cows are milked by machinery, the attendants are dressed as carefully as surgical nurses, and the milk is pasteurized. Inspection by municipal authorities is frequent, and unsanitary establishments are speedily put out of business. It is impossible to overestimate the importance of pure milk as food, and authorities have come to insist very rigidly upon its quality. This has, of course, resulted in an increase in the price of milk, but the benefit is worth the

cost; it is astonishing that there was not more disease in the past, considering the carelessness with which the milk supply used to be treated.

Butter and cheese. Butter and cheese are two very important products of the dairy. The centers of their production need not be so near the market as in the case of milk. Until 1830 cheese was made in the farmhouses, and was given in exchange for supplies from the village stores; but thereafter it was realized that there were profits in cheese-making, and a change in the manufacture came about. Separate "cheese houses" were built on farms, and about the middle of the century the cheese factory came into vogue. The milk was collected over a wide area, conveyed to a favorably located factory, and there converted into cheese. The cheese factory, says one author, is the gift of the New York dairymen to the world. The factory system spread rapidly between 1860 and 1870; by 1866 the state of New York alone had over five hundred factories, and by 1870 there were about thirteen hundred in the whole country. In recent times the industry has continued to expand in a remarkable degree. Similarly butter factories have developed to take the place of the former home industry.

Centers of the dairy industry. Such specialization in the production of dairy products has resulted in giving us a dairy industry quite distinct from the live-stock industry with which it was more closely associated in its beginnings. The main centers of the dairy industry are in the Eastern states and in the various states of the corn belt.

Other products. There are other products of cattle-raising besides the beef and the milk. Chief among these are the hides. Cattle-raising is a different thing when leather is the product contemplated. But these aspects of the subject are to receive mention in a later chapter (XXII).

CHAPTER X

SWINE AND SHEEP

Swine

Nature of the animal. Swine were native to the Far East, but spread in very early times to the western world. They are easy to keep, being tame and hardy; and of all our domestic food animals they are the most prolific. They come to maturity in a few months. We kill, in an average year, over three quarters of our hogs without impairing their numbers. Further, the hog is not particular in the matter of his diet — is, in fact, a fine door-yard scavenger, eating anything and everything with cheerful lack of discrimination. It is pretty easy to keep a pig, and if facilities are available it is profitable to rear large numbers.

Early stages of the industry. Hogs were introduced into this hemisphere by Columbus in 1493. Later, the Spanish brought them to Florida, and the Portuguese to Nova Scotia and Newfoundland. There were swine in Jamestown, Virginia, in 1609; and they reproduced so rapidly thereabouts that people had to build palisades to keep them out of town. They were introduced into the Plymouth colony in 1624 and into New York the following year. But these early arrivals were of inferior quality; it has taken careful breeding, selection, and feeding to produce the best breeds of the present. In early colonial days, and on the Western frontier later on, pigs were not always, or even usually, kept in pens, but were allowed to run wild and feed on nuts, roots, and other forage.

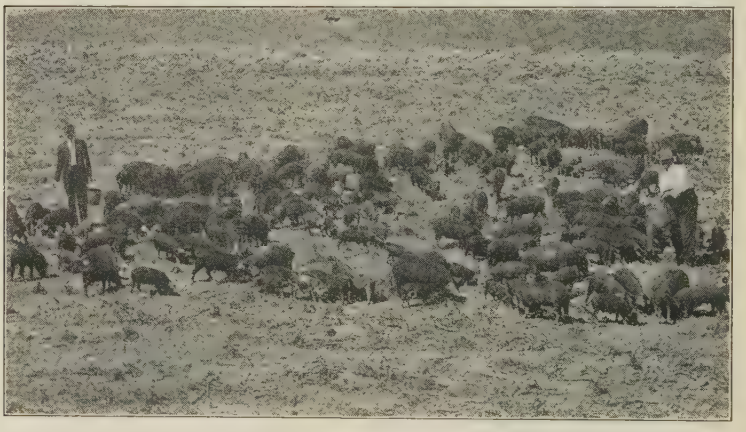
The wide use of pork. Pork has always been a palatable and, at the same time, a comparatively cheap meat. This is due chiefly to the fact that the hog lives on cheap food and is so wonderfully prolific. Pork is a favorite meat practically all over the world, even among many savage peoples; for the hog easily adapts himself to a variety of natural conditions and is at home almost anywhere.

Breeds of swine. Aside from the unimproved variety of swine there are numerous breeds well known to stock-raisers. Large size was formerly the chief aim of the breeding, without much regard being paid to the proportions of the body. Not until after the Revolution was much attention paid to improving our breeds of swine, but during the succeeding half-century considerable progress was made. Between 1820 and 1830 the Chester White breed was developed by crossing some white swine common in Pennsylvania with some imported white stock from England; and about 1830 the Berkshire breed was introduced from England. The latter breed yielded a good percentage of lean meat and was in favor as a producer of bacon and ham; but it was not until 1870 that it came into general favor. The Poland-China breed was developed in Ohio about 1840 by crossing other breeds; known under a variety of names until 1872, it was finally termed Poland-China in that year by a national convention of swine-breeders. Further favorable results were attained by crossing this breed with the Berkshire. It is astonishing to what scientific accuracy and effectiveness hog-breeding has now advanced; to become an expert breeder requires much ability, study, and experience.

Says an expert, writing in the Twelfth Census Report:

> The interest in swine-breeding in recent years is illustrated by the dates of first registration of the different swine-breeders' associations, which were as follows: American Berkshire, 1875; Standard Poland-China, 1877; Central Poland-China, 1879; American Chester White, 1884; American Essex, 1887; American Duroc-Jersey, 1890; and Standard Chester White, 1890. As a result of this interest on the part of breeders, swine in this country have attained an admirable standard with regard to form, bone, per cent of offal, and line of maturity.

Pork and slavery. Swine production in this country's earlier days had its close relations with slavery. Bacon was a cheap food, and was in great demand in the slave states for the slaves. But the planters who had the slaves did not raise many pigs, in view of the far greater profits to be obtained in planting a few large crops, such as cotton, tobacco, and sugar. This allowed parts of the country better adapted to hog-raising to find a favorable market for their pork products in the slave states; the corn states

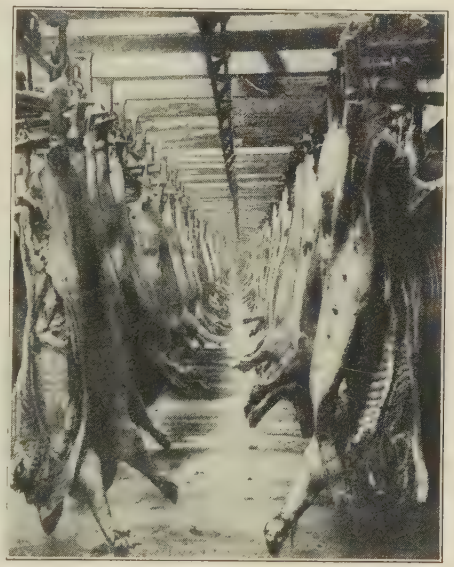


HOGS BEING CORN-FED FOR MARKET

in the northwestern section and in the Central West seized the opportunity and came to command the Southern market. For corn and hogs go together — where you find the one you are likely to find the other. "Hog and hominy" has been almost a synonym for food in general in certain parts of the country.

"Corn on the hoof." This relation of the two industries of corn-raising and hog-raising deserves further attention. It appears that certain farmers discovered that corn-fed pork was sweeter and otherwise superior to the swill-fed. But in the days before the building of Western railways corn was cheap enough, we have seen, to be used as fuel; it was certainly a sufficiently inexpensive stock food, for it sold, at times, for five or six cents a bushel.

The idea developed of herding the hogs in pens, instead of letting them range about as formerly, and of feeding them on the abundant corn. This enabled hog-raisers to put them on the market well fattened at any time they wished; and, once the enterprise had proved itself practicable, the industry developed rapidly in the corn states. This was about seventy years ago, in such states as Kentucky and its neighbors just north of the Ohio River; and from this region the industry spread farther westward with the march of population beyond the Mississippi. Even when railroads had come to form a network over these states, hog-raising continued on a large scale, because the pork could be sent to market as readily as the corn; thus the corn was sent in "on the hoof." A large pork-packing business soon developed in the Western cities; for Western hogs were largely packed when slaughtered, whereas those of the East were more commonly consumed freshly killed. The cities conspicuously associated with the pork-packing business in its earlier stages were Chicago, Cincinnati, St. Louis, Indianapolis, Milwaukee, and Louisville.

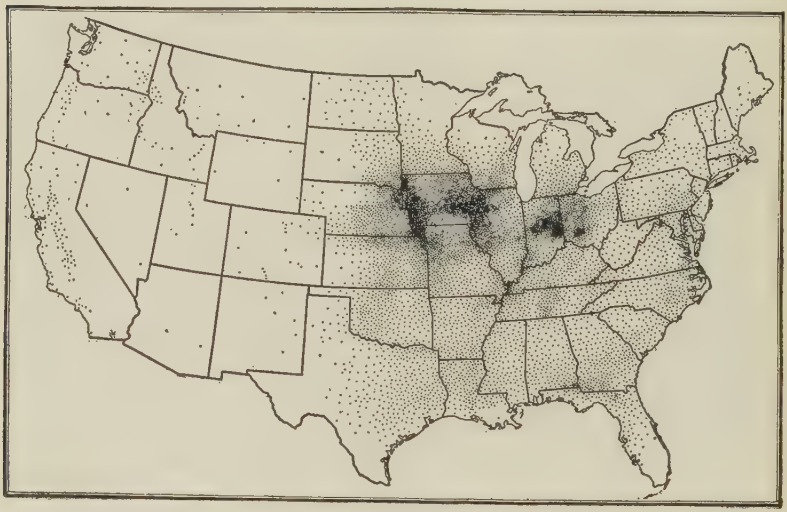


PORK IN A PACKING-HOUSE, CHICAGO

Location of the industry. At the present day the swine belt is practically identical with the corn belt. The great region for swine, not only for the United States but for the world, is that group of corn-producing states which we have already had occasion to mention: Iowa, Illinois, Nebraska, Missouri, Indiana,

Texas, Kansas, and Ohio. Considerably more than half of the swine in the country are to be found in these eight states, which retain a large percentage of their corn, in order to convert it into pork before it is disposed of.

The "lard hog" and the "bacon hog." The American hog is called the lard hog, as distinguished from the so-called bacon hog of Canada and Europe. It is the corn that makes the difference,



DISTRIBUTION OF SWINE IN THE UNITED STATES

After map from United States Department of Agriculture

for it is a great fattener. The bacon hog comes from the barley-growing districts of Canada and Europe. Since barley costs more to produce than corn, the stock-raiser in these countries cannot afford to feed grain to the swine, and so they live as far as possible on grass, and especially on clover. This diet results in more lean meat in the pig's body than is found in the American hog. People in America who like English bacon must send abroad for it; we therefore import bacon, although we export to England and Ireland vast quantities of cheaper pork. The most important center of European hog-raising is in the barley regions of Germany

and Russia, along the Baltic; these countries, next to the United States, are the largest producers of hogs; but we raise several times as many of these animals per annum as the two combined.

Pork-packing. In the case of swine, likewise, appear the wonderful economy and efficiency of the packing plant. Nothing is wasted. Hair, intestines, hoofs, and bones are utilized for mattresses, brushes, sausage casings, glue, fertilizer, and other products. Grease, soap, gelatin, etc. are by-products. The packing plants turn out more than a hundred articles which are not used as food. The meat is marketed in almost every known form — fresh, salted, smoked, canned, pickled, dried, and so on.

FILLING TUBS WITH PURE LARD

Slaughtering. In the case of hogs, we are led to remark upon the rapidity and efficiency of the slaughtering. This astonishing development of industry comes out, of course, in the butchering of cattle and sheep, but it is perhaps more in evidence in the case of the hog.

Says a writer in the Twelfth Census Report:

The hogs are driven to a large solid wheel, with chains fastened at intervals along the rim. With these chains the hog is shackled by one hind leg. The wheel revolves, slowly raising the squealing porker. As he gets near the top, the hog is detached automatically from the wheel, and a hook attached to a sloping rail carries the victim to the butcher. With a swift motion, almost

mechanical because of its long practice, the throat is cut lengthways, and the carcass is run along a short distance to allow the blood to run out, which is drawn off and used largely in the manufacture of fertilizers. After a short time has been allowed for this draining, the carcass is plunged into a bath of scalding water. It is then brought automatically to a table, across which it is dragged through a scraping machine by an endless chain. This machine does the work better than it could be done by hand, leaving the bristles in much better condition. It does its work very thoroughly, its blades being mounted on cylinders coming in contact with every part of the body. To insure perfect results, the body is then gone over by hand scrapers, after which the carcass is thoroughly washed with a hose. Next the head is nearly severed, the gambrels are cut, and the body suspended by them from the rail.

The body is then opened and dressed, the leaf lard is removed, the head is taken off, the tongue removed, and, lastly, the body is split in two. All this is done at the rate of twenty hogs per minute. Thence the two halves go to the chill room, where they remain about twenty-four hours, until after the animal heat has left the body and it is thoroughly chilled. After this the sides are run to the cutting tables.

Sheep

Utility of the animal. The sheep is yet another of the anciently domesticated animals; the wealth of the Israelites and other pastoral peoples of antiquity was largely in sheep, which were originally raised for their skins and milk as well as for their meat. They also figured largely in religious ceremonies, being one of the chief sacrifices. In modern times they are valued for their flesh and wool; and improvements in breeding are designed to better their qualities along these lines.

Early sheep-raising. There were wild sheep in America before the Discovery (the Rocky Mountain sheep has always been an interesting animal to the hunter), but there were no traces of domestication. Later the Indians of the arid states of the Southwest became great sheep-raisers, but their animals were descended from Old World stock. The domesticated sheep was probably a native of Asia and thence spread widely over the face of the earth. Columbus, once more, was responsible for the introduction of the Old World product; he brought sheep to America in 1493. Of all the early European settlers the Spanish and English were

most active in bringing over the sheep. In the sixteenth century the Spaniards introduced them into Florida and Mexico, where they multiplied rapidly and whence they speedily spread both north and south, especially into Texas, New Mexico, and Utah. The English brought sheep to Virginia in 1609, but their increase was slow at first, owing to the destructive activity of wild animals; and the same was true in New York, whither they were brought from Holland in 1625. In early colonial times sheep-raising

A SHEPHERD AND SHEEP

could be most safely carried on in regions which afforded natural protection against wild beasts, as, for instance, on the islands along the coast.

The merino. The breed of sheep most prized for its wool is the merino, which, while it probably originated in Asia Minor and was thence brought to the West, received such care and underwent such improvement in Spain that that country is always thought of as the originator of the breed. The merino sheep is, so to speak, all fleece. His coat hangs loosely on his body, and its folds provide a great amount of space for wool; whereas the old unimproved German sheep had 5500 hairs per square inch,

the merino has 40,000; and he has a good many square inches to have his thousands on. And this fleece weighs him down to such an extent that he cannot leap fences and do damage as his longer-legged and less handicapped fellows can. Once upon a time a New England sheep-raiser became disgusted with his animals because they were always doing damage to neighbors' crops and getting him into trouble, and he tried to raise, from a queer young ram, animals whose legs should be so short and bowed that they could not jump fences. He succeeded, and the resulting breed was called Ancon. They were quite the rage for a time; but then came in the merino variety from Spain, which speedily ran the Ancons out of favor, so that now they are merely a name. The superiority of the merino lies in the fineness of the wool and in the amount or weight of wool for each individual fleece. The wool is so close as to enable the sheep to endure very cold weather; this ability to resist the cold and to live on the coarsest food, combined with an unequaled docility, has made the merino very satisfactory wherever it has been imported.

MERINO RAM

Introduction of the merino. In order that the very best wool might be available for home manufacture, there were imported into this country, in 1810, twenty-six thousand merino sheep, which were distributed throughout the country. Owing to the depression in the industries of the United States following upon the Napoleonic Wars, in 1815 and 1816, wool could not be marketed, and so whole flocks of merinos were slaughtered; but

with the revival of manufactures after 1820 attention was again given to the merino. By this time, however, the Spanish merino had been bred with the native Saxon sheep, producing the Saxony merino, in which an extreme fineness of wool had been developed at a sacrifice of other qualities. But the marked physical weakness of the Saxony merinos, together with the general decline in the value of wool, prevented them from ever gaining a strong hold in this country.

The karakul. A new departure is now being made, in both the United States and Canada, by the introduction, on special ranches, of the so-called "karakul" sheep. These are common in Bokhara, western Turkestan, and neighboring regions and produce the valuable article, ranked as a fur, called Persian lamb. The results so far obtained since the introduction of karakuls, in 1908, indicate that there are possibilities of raising them here, but the final outcome is uncertain. The pure-blood lambs yield the most valuable pelts; but when karakuls are crossed with our ordinary breeds of sheep, there is said to be a marked improvement in the wool and in the character of the mutton as well, and the lambs are said to be heavier than the average of those born of our usual breeds.

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THE SKIN OF A KARAKUL LAMB

The mutton breeds. There was a marked change in the sheep industry about the middle of the nineteenth century, consisting in the transition from the raising of the fine-wool sheep to the

production of the coarse-wool and mutton sheep. The mutton breeds were brought from Canada and England and were widely distributed east of the Mississippi River. This grade of sheep helped to increase the output of distinctively combing wools; and to improve the mutton breeds French sheep were introduced and crossed with other varieties. In the states east of the Mississippi the mutton breeds gradually gained the ascendancy; farther west, as population increased and meat became relatively more in demand than wool, the mutton breeds came to be preferred. The total consumption of lamb and mutton has increased appreciably during the last ten years; a few years ago more than nine and a half million sheep and lambs were slaughtered in plants subject to federal inspection. The number now averages a good deal above this figure. Besides the mutton there are other carcass products derived, such as tallow; one of the objects in raising sheep is to get their fat. In the past there was even a variety known as the "fat-tailed sheep," which had large deposits of fatty tissue at the tail — so large at times that the tails required artificial support in the form of little carts. Other products of the carcasses are such as are derived in the packing-houses from cattle and swine. The so-called "catgut" is made from sheep's entrails.

A FAT-TAILED SHEEP

Breeding for meat. At the outset of the twentieth century the merino and English types of sheep were nearly equal in number in the United States, but since that time there has been a marked tendency to increase the mutton breeds, especially in the more thickly populated regions east of the Mississippi.

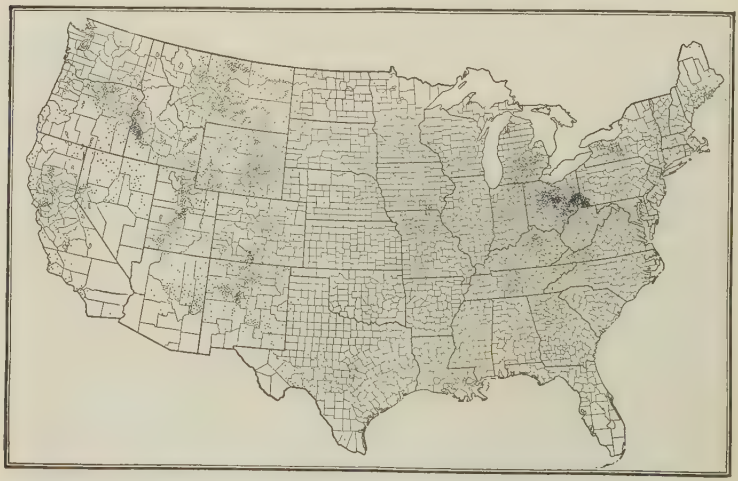
Westward movement of the industry. Owing to the abundance of good pasture land in the West, the center of sheep-raising has moved westward along with other pastoral industries. Before 1840 there were about 18,000,000 sheep in this country, of which the greater number were in the Atlantic states, between Virginia and Maine inclusive, and in the Ohio River basin. In 1850 and 1860 Ohio, New York, and Pennsylvania, in order, were the

A SHEPHERD AND HIS FLOCK

states having the most sheep; in 1870 Ohio still led, but with California second, and New York third; in 1875 California had reached first place, followed by Ohio, Texas, and Michigan; in more recent times the order became: Wyoming, Montana, New Mexico, Idaho, Ohio, California, Oregon, and Texas. There have occurred some interesting shifts, but the West has won out. However, there are many sheep east of the Mississippi still — about one third of the total number; in fact, sheep are to be found in respectable numbers in every state in the Union. The

number in New England is small, though this section offers attractions for sheep-raising. The case of New England is not so bad as it was represented to be by the humorist who said that the sheep farmer had to let his sheep down between the rocks, by the hind legs, to get the few blades of grass.

Other sheep-raising countries. The United States is one of the leading sheep-raising countries, but comes third after Australia



DISTRIBUTION OF SHEEP IN THE UNITED STATES

After map from United States Department of Agriculture

and Argentina; other important producers are Asiatic Turkey, Russia, the United Kingdom, Uruguay, New Zealand, and South Africa. It will be noted that several of these are in the south temperate zone. This zone, with less than 1.5 per cent of the earth's population, has well on towards one half of the sheep; it shows ten sheep per person, whereas in the world as a whole there are about three sheep to eight persons. The countries are remote, semiarid, and sparse of population; the sheep thrive, and there is room enough. Sheep are stupid and defenseless and have to be taken care of, and that is done by nomadic herders

and sheep dogs at very small cost. The relation of sheep-grazing to rainfall has been expressed as follows: In Australia a plain with ten inches of rainfall will support ten sheep to the square mile; if there are thirteen inches it will support twenty sheep; and if there are twenty inches, seventy sheep.

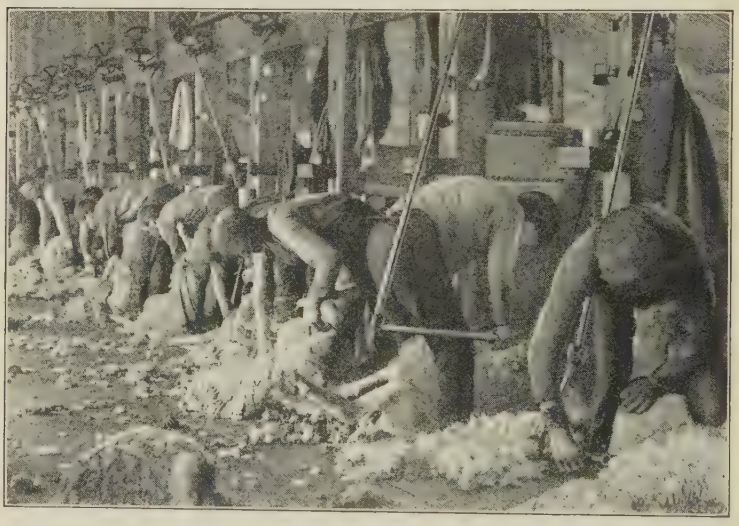
Wool and shearing. Our domestic wool is of two distinct classes: that which is taken from live sheep and that taken

SHEEP RETURNING IN AUTUMN TO THE VALLEYS

from carcasses and known as "pulled wool." Of our total production of a little less than 300,000,000 pounds, by far the largest proportion is sheared wool. It is the common practice in America to shear sheep but once a year, generally in the spring, but in the South and Southwest they are often shorn in both spring and fall. The reasons for double-shearing are varied, the factor of climate (heat) being the chief one; loss of wool from the tearing off of the longer fleece on underbrush is another reason. The two fleeces generally outweigh a single one, but the

extra wool, it is said, does not, in all cases, make up for the cost in time and labor of the second shearing.

The increasing weight of fleeces. At the beginning of this century the average weight of a fleece was 6.7 pounds, which was 1.1 pounds greater than in 1890 and 1.9 greater than in 1880. During the last half-century the average weight of the American



SHEARING SHEEP

fleece has increased about 140 per cent—a fine tribute to the efforts of the sheep-breeder. At present the average weight per fleece has risen to above 7 pounds; thus the increase within the last fifteen years or so has not been as marked as it was in the preceding decades.

Wool imports. It is somewhat surprising, in view of the fact that we raise so many sheep, to find that normally we import up to more than one half of the wool required for domestic consumption; during the last few years, according to a report of the Secretary of Agriculture, these importations have ranged from nearly 250,000,000 to over 400,000,000 pounds each year, the average being over 300,000,000.

CHAPTER XI

HORSES AND MULES

Introduction of the horse. Fossil remains prove the existence of the horse both in the Old and the New World in an earlier geological period. But he became extinct on this continent, so that when America was discovered there were no horses here. The first brought over came with Columbus, who carried with him, as we have seen, several varieties of domestic animals on his second voyage, in 1493. The first horses in that part of America which is now the United States were landed in Florida in 1527; there were forty or so of them, and they all died soon after their arrival. De Soto took horses with him on his western journey, which were abandoned and became, in all probability, the ancestors of the wild horses of the Southwest, on the Texas plains and the prairies. These animals were, then, of Spanish origin. The French introduced horses into Acadia in 1604; in 1609 English horses were brought to Jamestown, Virginia; in 1623 horses of Dutch origin were introduced into New York; and in 1629 came the first arrivals in Massachusetts.

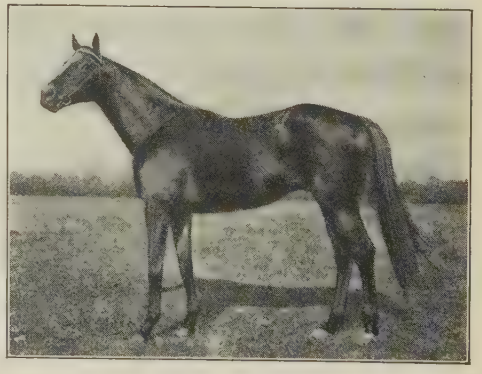
Horse-breeding. At one period in our colonial history horses were so cheap that careful breeding was neglected and the animals ran down in size until the colonists became anxious about the matter and put into effect laws to forbid the breeding of undersized horses and to prohibit them from ranging at large. It is said that the typical American horse has sprung from the

stock imported into Acadia, Virginia, New York, and Massachusetts, constantly improved by crossing with the best Old World breeds. The really significant improvements — in size, strength, speed, and other qualities — have been made within the last century.

THE EXTINCT FIVE-TOED AMERICAN HORSE

A United States census report speaks of this matter as follows:

The first horses imported for breeding purposes were the English thoroughbreds, a cross between the Arabian and the Barb. They were brought to this country about 1750, but the total number imported prior to the Revolution did not exceed fifty horses and twenty mares, which were distributed in Maryland, Virginia, New York, and North Carolina. Immediately after the Revolution, however, racing became popular, and many thoroughbreds were imported. The French-Canadian horse is the descendant of horses brought to Canada by the French. They have become reduced in size, but still retain the good qualities of their Norman ancestors and constitute one of the best breeds of farm horses. Roadsters and, in less degree, coach horses are bred from trotting stock. There are English and other foreign breeds or types of coach horses, but they are not much used in this country. Foreign draft horses of all the well-known breeds have been constantly imported into this country, but the English Draft, the Clydesdale, and the Percheron are most common. There are also Belgian and German horses.



A THOROUGHBRED

Improved breeds. An important event in the horse-raising industry was the importation of the Percheron breed; this type of horse was a great improvement in the type of draft horse. Before this the best burden-bearing horse had been the Conestoga, a type associated with the well-known stage-coach period, when the Conestoga wagons plied between Philadelphia and Pittsburgh.

Horse-racing. The trotting horse is, to a very large degree, an American product. When Americans took up horse-trotting as a

A CONESTOGA WAGON

sport, they soon developed a type of trotter which could outrace all comers. For the trotting horse good roads were a necessity, and as good roads are a nineteenth-century product, so is the trotter; up to near the middle of the last century the buggy was little known, as the usual method of traveling was on horseback.

The horse car. The introduction of the horse car on the streets of American cities, and its general use for a period, created a new demand for horses. Cities and towns everywhere, but especially in the West, were growing rapidly, and business in general

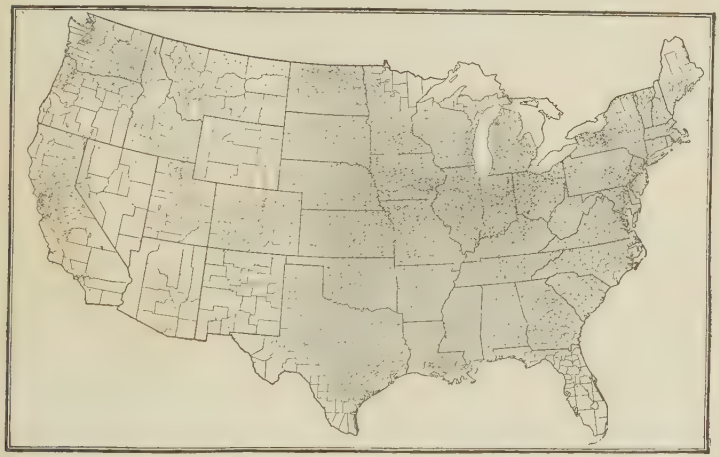
was very good. The introduction of horse cars called for a great many horses, whose lives in the cities were short. This was due to rough pavements and other unfavorable conditions and also to ill-usage. Horse-breeding was much stimulated, and in the nineties the supply began to overtop the demand. By 1895, however, electric plants were so widely installed in connection with street-car systems that the horse was practically supplanted in that

THE FIRST RAILWAY CAR IN WASHINGTON

industry. This change threw many horses, formerly used for hauling street cars, on the market, and soon the demand for cheaper animals was gone.

The demand for horses. The widespread extension of the trolley into country districts stimulated the demand for horses. Population grew up along the new transportation lines and, rents being low in the suburbs and country, people settled farther and farther out. But until the development of the trolley express they needed horses for the transportation of their goods to the city. Also the tremendous foreign demand for wheat and other cereals has brought about heavy exports, and more and more horses and mules have been needed to cultivate the land. The domestic demand for the cereals has increased at the same time; and the heightened interest in beef and other animal products has called for an increased production of corn and hay for feeding purposes.

But such a development has demanded more cultivation and more animals. In fact, since about 1896, when horse cars were becoming extinct, there has been a considerable foreign demand for our horses. This exportation was stimulated at first by the very low domestic prices of American horses and, later, by the great European War. On the whole, in spite of the swift advance of the electric railway, the bicycle, automobile, and motor truck, as well



DISTRIBUTION OF HORSES IN THE UNITED STATES

After map from United States Department of Agriculture

as of all sorts of farming implements driven by mechanical means, the development of horse-production has progressed at a fairly even rate.

Regions of horse-raising. The farmers and ranchmen of the Western states raise more horses for the market than do other producers. The "blue-grass region" of Kentucky, with Lexington as a center, is one of the well-known districts for horse-raising. Here are reared mainly trotters and driving horses instead of draft animals. Horses, also, go with corn production; the colts are fattened on corn and sent to Eastern markets.

Horseflesh. We have considered the horse almost exclusively from the standpoint of his use as a transportation agency. Originally, like the rest of the domestic animals, he was eaten; and he still is. It is difficult to say just how much horseflesh is eaten in this country, for it is not a popular food. Doubtless this prejudice will sometime disappear, under pressure of need, as it has done on occasion heretofore. A good deal of horsehide is now and has always been used, — baseball writers commonly refer to the ball as "the horsehide," — but whatever there is to say about horse leather, as well as about pigskin and sheep leather, will come in better under the leather industry, to be taken up in another chapter.

Mules

Nature of the mule. The mule is a cross between the ass and the horse and has been known since remote antiquity. It is a very tough and hardy animal and excellent for draft use. It can stand a warmer climate than the horse and is therefore commoner as a carrier in our Southern states, where there are, in some cases, more mules than horses. Says a census report again:

> The hot, moist climate is quickly fatal to horses when hard worked, while mules bear it with impunity and endure hardship, overwork, and ill-usage without great loss, an element of considerable importance in a country where work animals are handled largely by ignorant and careless laborers. Their hoofs are very hard, and are shod either not at all or at infrequent intervals. Their average working life is longer than that of horses. It is claimed that the mule will do equal work on less food than the horse, but this is open to serious doubt. They will, however, eat coarser forage, and can be carried through the winter in fair condition at less expense.

Virtues of the mule. It has been said that the reason why the mule does not displace the horse in a country like this is in large degree a matter of pride; the horse looks more respectable and acts better than the mule. However, the mule is credited with more intelligence, especially in work on mountains and in mines. It is a calm, obstinate animal, hard to "rattle," and has been

known since antiquity for its sure-footedness. To "work like a mule" is a phrase that explains itself; as long ago as Homer's time mules were called "hard-working." It is fair to say that the mule does not deserve his unpopularity, but he evidently has no pride to injure.

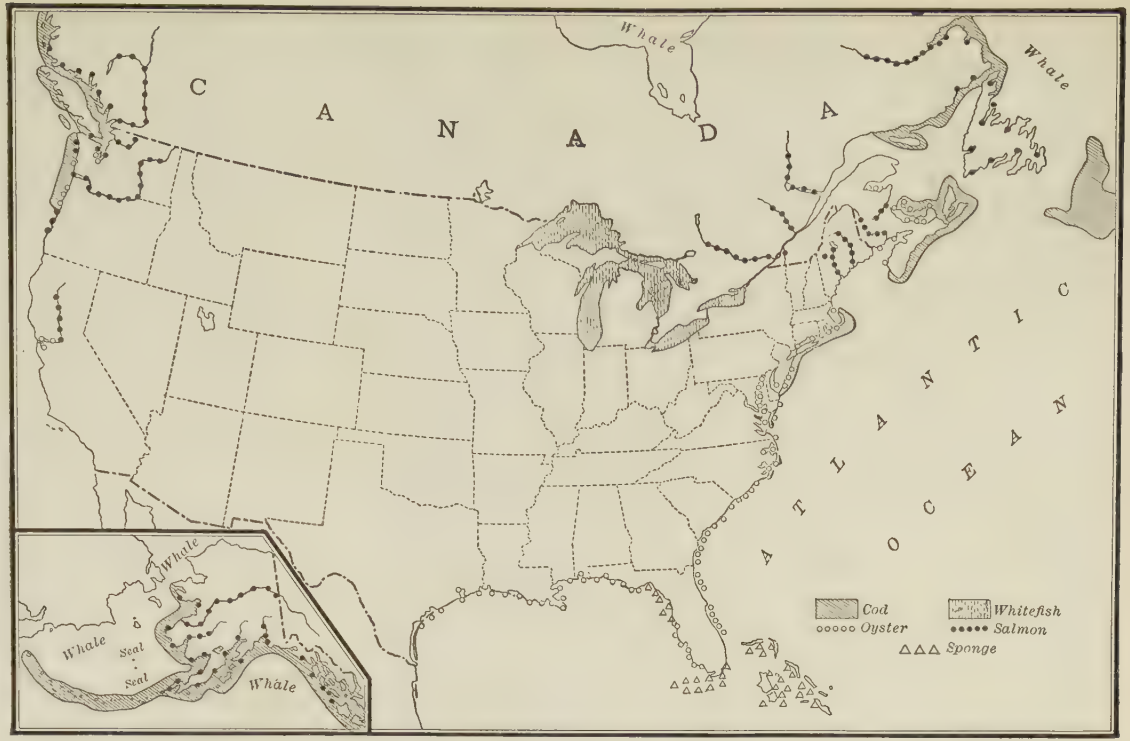
Value of the mules. There are at the present time over four and one-half million mules in the United States — about one fourth the number of horses. Their rate of increase for the last fifty years has been approximately the same as that of horses. The present farm value of the mules is not far from half a billion dollars.

CHAPTER XII

FISHERIES

An important resource. Fishing is comparable to hunting rather than to the raising of domestic animals. There is no field for taming and domestication of fish; it is a question of taking advantage of a supply provided by nature and, later in the development, of conserving and stimulating that natural resource. It is needless to say that men have practiced various methods of securing food from the water fauna since the beginning of human development, and the possibility of getting such food has had, throughout history, a powerful influence upon the destiny of nations.

Fishing in our early history. Had it not been for the fishing possibilities the early history of our country might well have been very different from what it was. The earliest explorers and navigators noted the abundance of fish in American waters, and also of whales, which are really mammals but which are generally included in a treatment of fisheries under the topic of "whale fisheries." The New England colonies in particular owed their origin in no small degree to the opportunities for developing fisheries in their waters and in adjacent stretches of ocean; one of the main ideas in founding settlements in Massachusetts was to build up fishing interests. Massachusetts became, from the beginning, a center of fishing activities, and the same thing may be said, in less degree, of the other New England settlements. Farming and fishing went hand in hand, but the former pursuit



PRINCIPAL FISHERIES OF THE UNITED STATES, ALASKA, CANADA, AND NEWFOUNDLAND

was subsidiary; every good harbor became crowded with boats and fringed with shipyards. There stretched along the shore, from the New York end of Long Island Sound to the Saint John River, a fringe of villages whose chief interest was fishing. Among them certain ones, such as Gloucester, attained great prosperity and reputation. As early as 1731 Massachusetts had 600 vessels and 6000 sailors at sea, half of them in the fisheries.

Fishing grounds. Our fishermen have had access to one of the two leading food-fish areas of the world. One of these comprises the waters of western Europe, with the North Sea as a center, and the other the western waters of the Atlantic, especially along the coasts of Newfoundland, the maritime provinces of Canada, Quebec, and the New England and Middle Atlantic States. A great variety of fish inhabits the waters covering the eastern continental shelf of North America — cod (the "beef of the sea"), mackerel, herring, halibut, and many others. Formerly whales also were common in these waters as well as farther away.

New England's fisheries. It is not surprising that New England should have held nearly a monopoly of the commercial fisheries of this country until near the middle of the nineteenth century, but this was not due solely to its fish resources. It was a question of the comparative profitableness of fishing as over against other occupations. South of the Hudson River the middle colonies raised cereals, and the Southern colonies tobacco, rice, and other warm-climate products; while forests yielded lumber and naval stores. Though these southerly states had good offshore and inshore fisheries, their agriculture was so much more profitable for the time that the fisheries were relatively undeveloped. But in New England, while agriculture was the most important single industry, it did not so absorb all attention; in many respects the sea industry was more profitable. Out of it, too, rose shipbuilding, navigation, and commerce, which gave to New England a greater variety of industries than was to be found anywhere else in the colonies.

Fishing and shipping. Here we must stop to consider the fact that the fisheries of any country have a very close and intimate relationship with various other aspects of national life. A considerable percentage of the marine tonnage of important maritime countries is always engaged in deep-sea fishing. Very often it has been true that a nation has owed its general maritime preeminence to the schooling in seamanship which its people have

A NEW ENGLAND FISHERMAN IN THE EARLY DAYS OF THE INDUSTRY

acquired in fishing. Such an influence the fishing industry of the United States has had upon its shipping and other interests, both in individual states, as in the case of New England, and in the country at large. The best sailors that we have had in the merchant marine have come from the coasts where the chief industry has been fishing for cod, mackerel, and whales. These men had learned to encounter without fear all the perils of the sea; they sailed in the heaviest weather and "never struck a topsail as long as there was a mast to fly it from." These were the men who won our naval triumphs in 1812, and they long remained the most valuable element in our whole maritime

establishment. Their ships visited every corner of the earth, often being the first in the field, and they thus became the pioneers and scouts of our merchant marine. It is said that the first American flag ever seen in England was on the mast of a whaling ship which had entered the Thames. The life of these fishers was fraught with great dangers, particularly on the Grand Banks of Newfoundland and in the whaling voyages; the reader of Kipling's "Captains Courageous" and Dana's "Two Years before the Mast" has gathered some idea of the life they led. It was a rough existence, but those who had endured it contributed strength to the fiber of the nation.

Fishing rights. Strictly speaking, the fishing that is done in national waters must be within the three-mile limit from the shore, as only that belt belongs exclusively to a nation. Beyond that limit anyone has the right to fish. Naturally there has been a good deal of dispute, with recourse to legal proceedings, concerning fishing rights.

Fishery products. But we must not, beginning as we do with sea fishing, fail to realize that a good part of our fish resources are in the lakes and rivers, or forget that there are other water products which are to be reckoned into our fisheries. There are many articles other than food that are derived from the fisheries, — for example, oils, fats, and waxes; furs and leather; fertilizers; shells; bones and ivory; glue; isinglass; sponges; and so on. Numerous industries are organized to work up these various sea products.

Importance of our fisheries. In tracing further the development of our fisheries we find that the wars — the Revolutionary War, the War of 1812, and the Civil War — all dealt severe blows to our fishing industry. But it recovered from them all and now surpasses that of any other country in the world. We shall take up a few of the important branches of fishery, briefly tracing their development.

Whaling. This industry began on Long Island, in the cutting up and trying out of stranded whales; it was a sort of community business, and citizens were summoned to do their part

when there was a chance for it. Later they took to small, and presently to larger, boats and ships, and did not wait for the sea to throw up the booty. But the whaling industry as a big business did not get a strong hold among us until after the War of 1812. Up to that time it was a more or less important New England enterprise. The tonnage of whaling vessels in 1818 was less than seventeen thousand. By 1860 the size of the whaling fleet had so increased that the annual value of its takings exceeded

HARPOONING A WHALE

From an old print

the value of the products of all other fishing interests put together. Our whalers went to practically any place on earth where their prey was to be found, and the products of their labors formed an important item in our foreign trade. Massachusetts was the center of the industry, and the names of Nantucket, Marthas Vineyard, New Bedford, Gloucester, and Marblehead were identified, in practice and in story, with this picturesque vocation.

Decline of whaling. But soon after the middle of the nineteenth century whaling began to decline. The whales were becoming more scarce, and the perils and cost of getting them, in arctic latitudes for instance, were on the increase. Then, too, the

expanding manufactures of New England attracted investment. At just this time, to put on the finishing blow, when the production of whale oil was falling off and its price rising, petroleum was discovered, and "the prosperous days of the whalers ended when oil poured forth from the rocks beneath the surface of the earth at Titusville, Pennsylvania." Scarcely any other industry in the country has shown such a revolution as that of the whale fishery during the last sixty years. Formerly capital to the extent of tens of millions of dollars was invested in it, and it gave employment to tens of thousands of men; but now it has declined to a position of comparatively small importance, even in those regions where it formerly flourished most. Whale oil is still in some demand, and the high price of whalebone is a stimulus that keeps some life in the whaling industry. But the old whaling towns have fallen on evil days, or have been obliged to set their course of destiny by other stars. They are in ruins, or have had to sacrifice their romantic and picturesque character by adapting themselves to other vocations.

Cod-fishing. In colonial days cod-fishing was an important industry, especially in New England. After the Revolution it struggled with adverse taxation levied on hooks, lines, cordage, and duck, but by 1829 it was on the upward trend, and from 1820 to 1860 it was generally prosperous. The highest tonnage ever employed in the codfishery was in 1860, when it reached 136,654 gross tons. The leading states in this industry were Massachusetts and Maine. Cod-fishing has not declined as much as whaling, though it has diminished somewhat in importance since 1860. The lessened demand for deep-sea fish has been brought about by a rapid increase in the takings of cheaper kinds of sea foods, such as salmon, herring, and shellfish — cheaper because of the smaller expense incurred prior to their arrival at market. Many ports of Maine and Massachusetts from which great numbers of vessels had made regular trips to the Great Banks of Newfoundland have given up this business in favor of the inshore fisheries. The supplying of fresh fish to summer

resorts has been found more profitable, as well as less dangerous, than the old offshore voyages which had been carried on during the preceding period.

Mackerel-fishing. The mackerel fishery did not amount to much except locally until 1820; up to that time the mackerel was commonly used as cod bait, and only those which were fresh caught were eaten. The first trip for mackerel, where the

DRYING FISH AT GLOUCESTER, MASSACHUSETTS

idea was to salt them on board, is said to have been made in 1818; but when once the possibilities of salting were seen, the enterprise speedily developed. It was never as sure, however, as cod-fishing; the fisherman can usually find the cod, but the supply of mackerel is likely to vary from season to season and from place to place. Also, as long as the fish had to be taken by line — before the invention of the purse seine, late in the century — the catch was often small because the fish would not bite. Massachusetts has been the center of this industry, which has, like the codfishery, declined somewhat since the Civil War.

Other fisheries. Other important fisheries of New England are the herring, shad, halibut, oyster, lobster, and menhaden. It should be noted that drying and salting fish as a method of preservation is not so nearly universal as it used to be. The vessels engaged in deep-sea fishing nowadays make much use of ice, thus keeping the catch fresh until they return to port. Power boats are now much in use, especially inshore, and the fish can be hurried back and marketed without being cured in any way. Then, by refrigerator cars, fresh sea-products may be speeded far inland.

New England's supremacy. What has been said about fisheries applies in large part to New England, which is really the great center of the industry. Gloucester has long been famous as a great fishing port, with several thousand people employed in the work; the same is true of Boston. A large percentage of the annual catch is made directly off the New England coast. Thus New England deserves prominence in a treatment of fisheries; her lobster and oyster industries will receive mention a little later on.

Fishing south of New England. Despite New England's long start, the fisheries of the Eastern coast south of New England are now the most valuable which we have; they did not come into prominence until 1850, but have since then attained their eminence. This has been due to several causes: railroad development, increase of population, use of refrigeration, and development of the canning industry. New England was supreme so long as fish were merely salted or pickled. With the growth of population and rapid transportation, together with the use of the refrigerator car, people not alone on the coast but inland began to develop a fondness for fresh fish, and the cured cod and mackerel could not compete. In any case the demand became larger than New England could meet, and the North and South Atlantic states broke into the market. The former group of states furnished not only cod and other offshore fish but shad, bluefish, and oysters. New Jersey and New York are the leading producers. Among the South Atlantic states North Carolina occupies a prominent place with the oyster, mullet, shad, trout, striped bass, and clam.

Gulf fisheries. Of the Gulf-coast fisheries it may be said that they have rich resources available, but that they attained commercial importance only after 1860; as yet they are only partially developed. Florida's fisheries exceed those of the other Gulf States in productivity and include a great variety involving the oyster, mullet, sponge, and shrimp.

CATCHING SALMON WITH A SEINE

Pacific-coast fisheries. The fish of the Pacific coast are about the same as those of the Atlantic coast in the same latitude, namely, cod, herring, halibut, and the rest. But it is the salmon that gives prominence to the Western fisheries. Nowadays the salmon fishery is important only on the Pacific. The salmon come up the rivers to spawn, filling the beds of the streams so that they appear to form rivers of fish, and are easily netted. Salmon-fishing was carried on by the Indians and early settlers, but it was not until the development of the canning industry, about 1864,

that the Pacific salmon came into commercial prominence. Since then, both in the Pacific states and Alaska, the industry has enjoyed a rapid development.

Sealing. Perhaps in the interests of completeness the fur-seal industry of Alaska should receive mention, although it does not belong to the United States proper. The Pribilof Islands, in

AN ALASKAN SEAL ROOKERY

Bering Sea, remain the breeding ground of the largest fur-seal herd in the world. Since Alaska was purchased, in 1867, the government has received a revenue of several millions for the privilege of taking seals. The leasing system was abolished in recent years, and measures have been adopted for preserving the seals. Next to the salmon fishery the fur-seal fishery is the most valuable on the Pacific coast.

Oysters. The most valuable item in the fisheries of this country, already referred to incidentally, is the oyster. Oysters are taken in greater or less quantities along the waters of practically

every state on the coast of the country, but the most productive areas are those of Chesapeake Bay and Long Island Sound. The Indians used the oyster and brought it, in the seventeenth century, to the settlers of what is now New York; it is said that Pearl Street in New York City received its name from the fact that it was once paved with oyster shells. The industry began a triumphant progress about 1850 in nearly all the areas which have since become important in production. This country furnishes 80 to 90 per cent of the world's supply of oysters.

UNLOADING OYSTERS

Lake and river fisheries. The fisheries of the Great Lakes and of the Mississippi River and its tributaries are of small significance relatively to those of the sea.

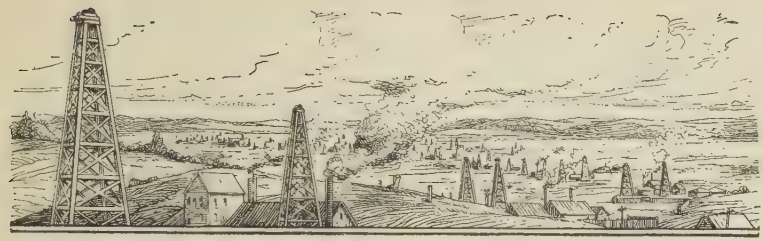
The promotion of our fisheries. Taken as a whole, the annual wealth produced by all our fisheries is less than the annual farm value of any one of our leading agricultural crops; it is but a small fraction of the value of our wheat. But that does not mean that it is not an important national industry. It has been so recognized of late, and efforts have been made to extend as well as to preserve it. The United States Bureau of Fisheries and various state commissions attend to the artificial propagation and distribution of young fish in interior waters, and there are numerous laws designed to protect fish that are desirable in commerce or sport. There are undoubtedly many varieties of fish

whose use is restricted because of prejudice or because they are unfamiliar; the authorities have organized enterprises to take such fish and introduce them into the market. Such a common water-creature as the porpoise has its possibilities in the particulars of hide, blubber, meat, and so-called "porpoise-jaw oil," which is of a very fine quality. To an age which has its attention directed

A CALIFORNIA FISH HATCHERY. PACKING SALMON EGGS FOR SHIPMENT

toward economies, the services of science in helping to keep down the cost of living by discovering cheap substitutes ought to be very welcome.

Government support. The office of Commissioner of Fish and Fisheries was created by Congress in 1871, and in 1903 it was made a bureau of the Department of Commerce and Labor — now the Department of Commerce. Among the duties of the Bureau is the increasing of the quantity and the bettering of the quality of our fish supply.



PART IV. MINERAL INDUSTRIES

CHAPTER XIII

COAL AND PETROLEUM

Minerals and mining. In Parts II and III we have seen something of the progress of American industries that have to do with living things — plants and animals. We come now to the minerals. There are, first of all, some obvious differences between plant and animal products, on the one hand, and minerals, on the other, which, obvious though they are, ought to be taken note of. The minerals are the typical natural resources; you can move animals and plants about from country to country, — we have seen that the best of our plant and animal industries have to do with imported stock, — but your minerals are just as they were originally laid down, and you take them as you find them. It is the minerals that have moved man, not man the minerals. Again, the minerals cannot be "raised"; they must ultimately become exhausted, while the domestic plants and animals may be made to increase at the will of man. Once again, the factors of environment — climate, rainfall — which determine organic life have no influence whatever upon the minerals. Coal occurs in any latitude whatsoever, irrespective of present-day climate; and if this is true of coal, which is, in origin, organic, it is not surprising in the case of the other minerals. The conditions favorable to the opening and development of a mine are the presence of population and

good transportation, and if the mine is rich enough it is likely to summon such conditions into existence.

Metallic and nonmetallic minerals. The minerals of commerce are unevenly distributed over the earth. Some are very common, as, for instance, coal and iron; others, as tin, nickel, and platinum, are extremely localized. Minerals may be classified conveniently into metallic and nonmetallic. The former comprise iron, copper, gold, silver, lead, quicksilver, zinc, aluminum, and antimony. There are to be found in the United States alone over fifty nonmetallic minerals; among them it is coal and petroleum that form the big items in industry and commerce. In our annual output of minerals, which is valued at about four to six billion dollars, the nonmetallic minerals exceed the metallic in value.

Importance of the mining industry. Imposing in amount and value as is our annual output of minerals, it is worth, on the average, only from one fourth to one third of our farm production; in certain years the corn crop exceeds in value all the nonmetallic minerals mined. However, the actual value in dollars of the products of a country's mines is no index of the relative importance of the mineral industry as compared with other pursuits within the nation. If it were, mining would have to be considered a secondary American industry. But it is clear enough that the progress of agriculture, manufacture, and commerce is in large degree dependent upon the use of minerals; progress in civilization in general has regularly depended upon their presence. With such considerations in mind, the reader will see that mere size and value of immediate product is not the decisive fact about an industry, and that the mineral industries have, in a sense, another sort of product that can scarcely be measured; namely, the basis and support which they lend to most other industries. This is particularly marked in the case of coal and iron, for upon these modern civilization really rests, and without them it could not have become, nor could it remain, what it is. Evidence for these general statements will appear as we go on to consider the various mineral industries of the country in a more special way.

Coal

Nature of coal. Coal is what was originally a vegetal deposit, laid down ages ago and subjected to great pressure; its existence and use remained unknown to man up to relatively recent times. European travelers in the early Middle Ages reported that the Chinese burned black stones, which smoldered and remained alight all night. There are two kinds of coal in common use: the bituminous, or soft, and the anthracite, or hard. The former contains from 85 to 88 per cent of carbon, lights easily, and burns with a bright flame. The latter is much denser in structure; it contains up to 95 per cent of carbon, lights with considerable difficulty, and burns with a bluish flame while kindling. Another variety, called lignite or brown coal, is of much less use in industry than either soft or hard coal; it contains only about 70 per cent of carbon. Soft coal is used for the generation of steam, while hard coal is used for domestic heating and cooking, especially in the eastern part of this country.

Soft and hard coal. Soft coal is mined chiefly in Pennsylvania, but a good deal is produced by West Virginia, Illinois, and Ohio. The largest field, called the Appalachian, extends 900 miles, from New York to Alabama, with a width of from 30 to 180 miles. A second field runs through Virginia and North Carolina, and a third across Indiana, Illinois, and western Kentucky. Hard coal is mined in Pennsylvania, where there is an anthracite area of nearly 500 square miles. The largest vein, called "The Mammoth," was once 40 feet thick, but has been almost mined away. It is necessary now to work the thinner veins, and the coal, unless carefully picked over, is likely to be full of slate and other stone.

Early use of coal. The colonists, of course, got most of their fuel from the forests. It was not till 1750 that coal was discovered, near Richmond, Virginia, and not much was done with coal-mining until after the Revolution, when there were shipments made to Philadelphia, New York, and Boston. Coal was found near Pittsburgh before 1760 and was in general use in the regions

near the mines, both for manufacturing and household purposes, at the beginning of the nineteenth century. Anthracite was discovered near Wilkesbarre, Pennsylvania, in 1762, but there was great difficulty in getting it into the market. The people of the time could not make it burn, and the first successful users were blacksmiths. Later on it was the invention of especially adapted grates, as well as the discovery that an anthracite fire ought not to be poked all the time, that helped its progress. Yet 365 tons from the Lehigh district were enough, even as late as 1820, to meet the demand. By 1831 the shipments from this region reached 40,000 tons.

EARLY USE OF COAL AT BLACKSMITH'S FORGE

The use of coal to smelt iron. Thus the production of coal for commercial purposes goes back, in this country, scarcely a hundred years. The Virginia deposits, near Richmond, were the first to be regularly mined; 48,000 tons were taken out in 1822, and 140,000 tons in 1833. Since coal is a bulky and heavy article for its price, only the mines which were near natural or artificial transportation facilities could be developed. It was not until coal was used in smelting iron on a large scale, and until the railroads had been built to carry coal to iron-smelting works, that the production of coal, especially of soft coal, received an impetus. The anthracite variety got a start over the bituminous because the

companies which first produced anthracite were also building the first railroads and canals. Until about 1840 the only fuel used in our blast furnaces was charcoal; although England had discarded it early in the century, our abundant forests and the relative ease of transporting wood caused us to retain it. When we first began to use coal in the manufacture of pig iron the iron industry was at once revolutionized. But anthracite was the principal coal used at first; the year 1855 was the one when anthracite first surpassed charcoal. Bituminous coal overtook charcoal in 1869 and anthracite in 1875.

COKE OVENS AT PITTSBURGH, PENNSYLVANIA

Coal and the railroads. The other great factor which caused the remarkable growth of the bituminous-coal industry was the rapid development of American railways, especially after the Civil War. This affected, in the first instance, the eastern and central coal states — Pennsylvania, Ohio, Indiana, and Illinois. It increased the demand for iron in railroad construction, thus involving the need of more coal, and it also opened up the westward shipment of coal, both for the railroads themselves and also for the industries that sprang up with the advent of the railroads. The close connection between the growth of our railway system and that of the coal industry is easily seen. In a country like this, where distances are very great, the fact that

coal constitutes the largest item of railroad expenditure causes railways to become interested from the very beginning in getting fuel at the cheapest possible cost. The great development of the iron and steel industry in the latter years of the nineteenth century, and its continued advance since the opening of the twentieth century, have greatly stimulated the demand for coal. The amount of iron manufactured by the use of anthracite has continued to decline, while the use of bituminous has steadily increased. This change was greatly stimulated by the use of coke, a residue of hard carbon left after heating certain grades of soft coal in ovens under a limited air supply. There are certain of our grades of coal, especially those of the Connellsville region of western Pennsylvania, which show superior coking qualities. Coke has come to be used more and more in the manufacture of pig iron, until over 90 per cent of this product is thus made.

Development of our coal production. The total amount of coal extracted from our mines up to and including 1845 is estimated to have been 27,700,000 tons, but 1846 saw a product of 5,000,000 tons; 1850, one of 7,000,000; 1875, one of 52,000,000; 1900, one of 270,000,000; and the present period a yearly output of over 500,000,000 tons, of which less than 100,000,000 are of anthracite. The total amount extracted from coal mines up to 1914 was 2,537,517,000 short tons of anthracite and 7,820,167,000 of bituminous, and the quantity still remaining to be mined is estimated as about 99.5 per cent of the original supply.

Our consumption of coal. The per capita increase in the consumption of coal in the United States has proceeded at a rapid, not to say a spendthrift, rate. It was less than a quarter of a ton per year in 1850, while it is now, despite the increase of population, more than five tons.

Waste and conservation of coal. We have been and are still wasteful in our employment of this great and never-to-be-replaced natural resource, both in the mining and in the use of it. There is great waste in mining: pillars of coal are left to hold up the walls, and thinner layers are disregarded; and it is even worse

when the pillars are robbed of their coal without being replaced by other supports. For every ton of coal mined and marketed, perhaps as much as half a ton is lost through waste in mining. Some of this is inevitable, however. The so-called "beehive" coke ovens are wasteful, and there are, all along the line, other leakages from this store of resources. The consumer is wasteful also: imperfect combustion is common; the full utilization of the energy stored in the coal is neglected. The feeling has been that there is an exhaustless plenty of this stuff and that it is cheap — so cheap, in fact, that it is more economical to save the time and effort necessary to realize economies of material. This sort of thing can continue in a new land with abundant natural resources, but there are unmistakable signs that our country is no longer a new one and that we have to give up some of the happy-go-lucky habits of our past. We shall presently be obliged to imitate certain of the ways of people of older countries, which we have viewed with amused and lofty contempt. Over the coal fields, and over the coal bins as well, there is being extended that movement for the conservation of natural resources of which we have spoken from time to time.

Coal is indispensable. For if one looks about him with a seeing eye he will observe that coal is something that stands, in a very real way, between modern nations and national decline — yes, national annihilation. Practically all our industries, by which we prosper, and even live, would be impossible without this natural substance. We can never hope to carry on our big industrial operations with wood as a fuel, even if we had the wood, which we have not. On the wood supply we could not even, for many years, keep ourselves warm enough to live. But the only other fuel is coal. It is hardly an exaggeration to say that in climates where fire is needed for living, coal has a large fraction of the indispensable quality which we usually associate with air and water. Once the race got along without coal and did not absolutely need it, but later on people got it and proceeded to build upon it as a necessity of life, until conditions have become such

that it is indispensable for life. Once, too, early man did not know how to make fire; but later he learned how, and the result has been that men are now living in many places on the earth where they could not exist without fire. It is impossible now to go back to the fireless age — even the "fireless cooker" needs fire to begin on. Coal made possible the development of a whole industrial and social system which was impossible without it. The size of population has increased in dependence upon this system. The system could not persist without the coal, and so the population and the living could not go on without it.

The need of economy in the use of coal. This is what we mean when we say that the failure of coal would mean, as things now are, national decline and annihilation. But coal, thus important for human life, is a substance limited in quantity on the earth; there may be huge deposits of it, but when used up it is not renewed, thus differing from air and water in a very serious respect. Therefore it behooves human beings, in the interest of future generations, to use this priceless commodity, cheap though it seems to be, with the least possible waste. It is already clear that the future is going to be less easy-going with us than the past has been; as the big coal veins are used up and the smaller ones have to be mined, the cost of coal, especially anthracite, must steadily rise. The realization of these facts may serve as a hint to a well-meaning but thoughtless people.

Petroleum

Early uses of petroleum. It is highly probable that petroleum ("rock oil") in some forms was in common use two or three thousand years before Christ. The Egyptians, Greeks, and Romans appear to have been familiar with some forms of petroleum, such as bitumens. "Sicilian oil" was used for illumination by the beginning of the Christian Era, having been formerly employed for burning in the lamps of the temple of Jupiter. In the Far East also bitumens have been in use for ages; the Baku

deposits of petroleum have been known and utilized, in one form or another, for a very long time. Oil from the ground, which was capable of burning brightly, would have impressed any primitive people as something supernatural, and it is not at all surprising that it should early have figured in religious ceremonies.

A medicine and a nuisance. There is evidence that petroleum was known and used by the Indians before the Discovery ; at any rate there are legends to this effect. It is characteristic of savages and half-civilized people that such a substance should be adopted as a medicine. The Seneca Indians gathered small quantities of petroleum, which they found in the springs ; and since the white settlers became acquainted with this substance through the Senecas, they knew it, for more than a century, by the name of " Seneca oil." Attempts were made to introduce it among the whites as a medicine, but in spite of the prevalent idea that a medicine, to be effective, must smell and taste abominably the bad odor and taste of petroleum made against its popularity. Then came the salt-makers, who were troubled more or less with petroleum in their brine. They had to dig deeper and deeper for salt as the demand increased with population, and finally began drilling wells. This was over a century ago. Some of these wells yielded more oil than brine, but it was regarded as a nuisance by the well-owners, who used all sorts of devices to get rid of what turned out to be a new natural resource.

Early steps in the industry. Attempts to bottle petroleum and sell it as a medicinal water, as well as projects to sell it as an illuminant, were failures — the evil odor and other disagreeable qualities worked against it. In the meantime, however, attempts were being made to distill oil from coal and shale, such oils not having the repulsive qualities of petroleum ; the results of these attempts suggested the possibilities of purifying the rock oil. But as there were no real oil wells the supply of crude oil was insufficient to lend much encouragement. Skimming water surfaces or deriving a small amount from brine wells was a discouraging process.

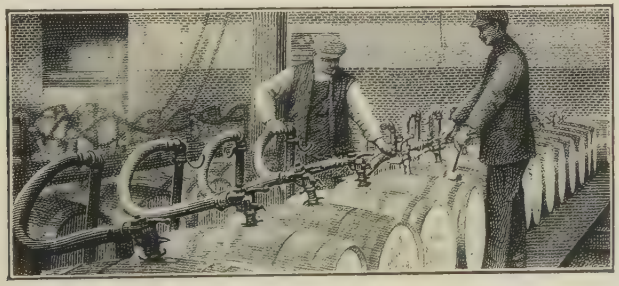
The coming of the oil era. It was 1854 before there was an oil company — the Pennsylvania Rock Oil Company — which made the petroleum industry its business. Incorporated in New York, its property consisted of one hundred and five acres of Watson's Flats, near Titusville, Pennsylvania, including an island where Oil Creek and Pine Creek joined. For eight or nine years oil had been gathered on this island from surface pits. In 1857, after the expenditure of considerable money by the original promoters, these properties were taken over by a company organized in Connecticut, and a plan was soon developed of increasing the yield of crude oil by well-drilling. Edwin L. Drake, a conductor on the New Haven Road, was put in charge. After a year of conflict with great difficulties he managed to reach petroleum in the first sand, thirty-three feet through rock and almost seventy feet below the surface. When the pump was applied, it was found that the well produced at the rate of twenty-five barrels a day. This was in August, 1859, which date marks the beginning of the real petroleum era in this country and in the world at large.

DRAKE'S OIL WELL

The oil craze. There followed a period of great excitement, recalling the gold strike in California ten years earlier. About 1860 western Pennsylvania was the scene of immense activity and speculation. Adventurers from all parts of the country hurried there and sunk wells in great numbers. Camps and towns rose out of the primeval forest all through this so-called "oil region."

Some of the wells promptly gave out and the population shifted elsewhere, so that certain towns which had sprung up as if by magic vanished almost as quickly as they had appeared. Pithole City, which in 1865 was the largest post office in the state, next to Philadelphia, has now disappeared altogether; its site became a farm.

Rapid development. For about fifteen years after the successful driving of Drake's well Pennsylvania produced almost all the crude oil for the country, but about 1885 the first important development outside of this state took place — in the Lima field



FILLING BARRELS WITH OIL

of northwestern Ohio. Men were searching for natural gas when they discovered oil. The development was rapid; four years later millions of barrels were being turned out annually. One by one other fields were opened up, each contributing its share in the development of a huge industry. An increase of a hundredfold or a thousandfold in a few years has been typical of the development, but it has not been possible to rest content at any stage. The oilman's creed, we are told, is to drill unceasingly in new fields and old.

Grades of oil. The oil areas of the United States are grouped in certain fields, largely on the basis of geographical position, but the grouping is coming to be based more and more on fundamental differences in the type of oil produced. The oils of the Appalachian field are mainly of paraffin base and free from

asphalt and other undesirable elements. They yield by ordinary refining methods high percentages of gasoline and illuminating oils. The Lima-Indiana oils and those of Illinois contain greater quantities of undesirable elements, while the mid-continent variety varies within wide limits. Oils from the Gulf field are likely to

FILLING A SHIP WITH OIL BY MEANS OF PIPES

have more asphalt, while the Wyoming and Colorado product is, in the main, of paraffin base and submits to the ordinary refining methods.

Oil production. This country contributes a high percentage of the world's product. Of our production the state of Oklahoma accounts for about 25 per cent, California for approximately 32 per cent, Texas for not far from 20 per cent, and Kansas for roughly 5 per cent.

Developments connected with the industry. The development of the petroleum industry has had a marked effect on the economic and social life of this country and on that of the whole

civilized world. The various commercial products of petroleum — such as kerosene, gasoline, benzene, naphtha, lubricating oils, paraffin, asphalt, and various by-products such as vaseline and candles — are now in common use, and many of these products are considered to be necessities; yet about half a century ago they were not to be had and the need of them had not been dreamed of. Our country is the great exporter of petroleum products to all parts of the world. The oil lamp is an example of an invention summoned into being by the industry, and now going out as other illuminants have superseded it. This lamp was largely an American product. Kerosene, when used as sperm oil had been, gave off a red flame, much smoke, and an offensive odor, but American ingenuity developed the burner and chimney to clarify the flame and avoid the smoke and odor; it was perfected by 1860, part of the work of perfecting it being due to Austrians.

Pipe lines and Standard Oil. There is another aspect of the influence of the petroleum industry on our national life, connected with its transportation. Special tank-cars and oil-containers had to be developed. The barrel was soon outgrown, even as a container at the wells. Then came the development of pipe lines conducting the crude oil hundreds of miles to the refinery. But this enabled the discoverers of this method — which demanded much capital and, after being built, constituted a monopoly — to squeeze out the smaller producers and to form one of the most powerful trusts in the world — the Standard Oil. Immense gains have been made by this corporation, but, with all its profits, it has over and over again reduced the price of oil.

CHAPTER XIV

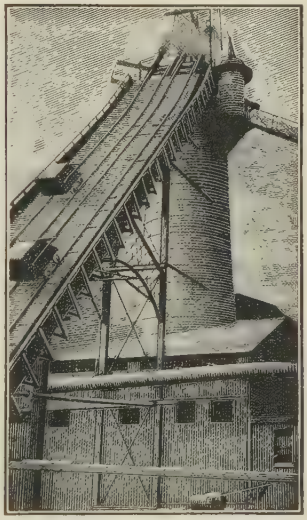
IRON

Iron in antiquity. Iron ore is widely distributed throughout the world; probably no other mineral except aluminum occurs in such abundance. No one knows when iron was first used by man, for iron rusts away easily and does not remain, like flint, or even copper, to bear evidence of the life of prehistoric ages. But it is probable that man learned to use the metal in extremely early times. In any case both Assyrians and Egyptians had it many centuries before Christ; in a dry climate like that of Egypt iron rusts away slowly, and so a few ancient iron implements have been found. Also there are many savage tribes known whose members are on a plane of civilization much lower than that of our remote predecessors but who are able to smelt a very good variety of iron and to make all sorts of efficient tools and weapons from it. It is reasonable to argue that if such people had arrived at the iron stage, certainly ancient peoples much superior to them in culture must have done so. And the oldest literature of which we know mentions iron as an everyday familiar object.

Early stages of the industry. However, it seems quite clear that the use of iron was not known in America previous to the Discovery. What metal implements the Indians possessed were of copper. The iron was here, but all the knowledge and skill needed to make it available had to await the coming of the white man. And the first form used was largely so-called "bog iron."

For a long time the iron used in New England was not mined, but derived from the lakes and ponds that abound in that section.

Smelting. Genuine iron ore, in order to be available for man, has to be smelted; thus the iron is obtained from the ore and freed of impurities. Of course the fuel used earliest was wood; the savage African made an underground retort, with alternate layers of ore and fuel, and assisted the combustion by the use of a blowpipe, worked with rude hand bellows. Later in the development of the industry, and lasting down to modern times, came the use of charcoal. This was the colonial method. The ore was placed in a bed of ignited charcoal, whose heat readily reduced it to a lump of metallic iron, one end of which could be hammered and drawn out into a bar. The product was "wrought," or "malleable" iron, or "bloom." Out of this still rude process was gradually developed the blast furnace, whose product was obtained in fluid condition and run into sand molds, forming "pigs." Other specially constructed molds were needed to form castings of various shapes. But the metal thus obtained was hard and brittle; it was "cast," as distinguished from malleable iron. However, owing to the fact that the blast furnace speedily became the regular agency for getting the metal from the ore, its typical product, the pig, has become the rough standard for measuring iron production. Out of this raw form comes practically all the finished iron and steel.



A BLAST FURNACE

The colonial iron industry. Having indicated the general lines of development in the process of ore treatment, we now return to the colonial iron industry. Aside from the collection of bog iron, there was some little mining and smelting in Virginia by

the early colonists, but it did not last. The Salisbury iron beds in Connecticut were among the first to be worked steadily; they were famous in their day, and for a hundred and fifty years were the source of an important industry. Anchors and cannon were made there at the time of the Revolution and in large numbers for that age, likewise many flintlock muskets. New Jersey, Pennsylvania, North Carolina, and Maryland also were mining iron ore twenty or thirty years prior to the Revolution. In New York, however, the opening of mines in the northern part of the state occurred only after 1800.

FILLING PIG-IRON MOLDS WITH MOLTEN METAL

The day of small things. We might say that at the time of the Revolution iron was being used, on a small scale of course, in every colony—in fact, that it was being manufactured in more places in the country than it is now. It was the day of small things and of poor conditions of transportation. The iron that was needed had to be produced locally, and the fact that the ore was so widely distributed made such local manufacture a possibility. It must be recalled that the British government discouraged the manufacture of iron, not wishing the English industry to be interfered with by competition or limitation of its market. This forced the production into out-of-the-way localities, since the regions most remote from the seaboard were less likely to be inspected and repressed. There was plenty of wood at hand, and so wherever there was any

knowledge of smelting, the process started up; and the product was a strong and excellent quality of charcoal iron. It was rudely formed into such articles — bars, nails, etc. — as were locally in demand.

Westward movement. During the half-century or more following the Revolution very little progress was made in iron-making; charcoal was still used, though it had been practically abandoned in England by 1800, for in England the coal and iron were in close proximity, and the wood was coming to be more and more scarce in some of the smelting districts. There was also, among us, little change in the general character of the industry; it was still local, although it had spread practically all over the country. There were fewer plants in the South, but the industry had crossed the mountains and was growing in Ohio as early as 1805. By 1840 furnaces and forges were numerous throughout the Central West. The industry was kept in its primitive condition chiefly because of the vast extent of the country, coupled with inadequate transportation facilities.

Conditions prior to 1860. Down to the year 1850 lead and iron were the only metals worth mentioning that were produced commercially in the United States. The output of iron fell off in the decade 1810 to 1820 from 54,000 to 20,000 tons; in 1830 it was 165,000, and double that figure in 1840. There were some ups and downs in the next years, but it touched 800,000 tons on more than one occasion. In 1860 it ran over a million tons.

The use of hard coal for smelting. During this half-century Pennsylvania was preëminent in iron production; in 1840 she produced more than three times as much as New York, the nearest rival; in 1860 over half of the iron produced in the country came from Pennsylvania. This state was much advantaged by the changes in type of fuel. Between 1840 and 1850 many experiments were being made with coal, both bituminous and anthracite, but it was 1849 before the anthracite iron became important enough to set the standard in iron quotations, so that the standard

became the ton of anthracite iron instead of charcoal iron. In the year 1854 the two fuels had produced almost the same amount, but in 1855 anthracite was 40,000 tons ahead.

The use of soft coal. This success was quickly neutralized by the entrance of bituminous fuel. This fuel was in common use in England long before we adopted it; it was about the middle of the eighteenth century that the English iron-makers took up the use of coke made from bituminous coal, but it was not until after the Civil War that the process got its momentum here. Anthracite was enabled to hold out because it was easy to get, cheap, and showed some advantages when it came to transportation; it was also near the iron region (Lehigh) where the start was made. But as soon as the center of the great coke industry — western Pennsylvania — became connected with the East by railroads, the geographical advantage of the anthracite area was at an end. In 1875 the bituminous fuel overtook the anthracite and the center of iron production shifted just across the Appalachian Mountains to the basin of the Ohio River.

Location of the mining regions. The iron mines upon which the industry now chiefly depends are those farther to the west; of the available iron ore about 75 per cent is in the Lake Superior region. It may be stated here that of the available iron ores at least half are owned by the United States Steel Corporation. This Lake Superior region (Michigan, Minnesota, Wisconsin) contributes four fifths, and the Southern District (Alabama, Georgia, North Carolina, Tennessee, the Virginias, Maryland, Kentucky, Arkansas, Missouri, Texas) about one seventh, of the total annual output of ore for the country. The old Northern District (western New England, New York, New Jersey, Pennsylvania, Ohio, Iowa) contributes a little less than 4 per cent.

The demand for iron. The output of the mines since 1870 has increased at an unparalleled rate. This is the great iron age: iron is used for railroads, structural purposes, ships, munitions, and a thousand other important purposes. We are so used to this fact that we fail to realize the amount of metal needed; but

let one stand by a railroad track and realize that the steel strip on which he places his foot reaches to San Francisco without a break — and not one strip alone, either, and not to San Francisco alone — and that all this metal has had to be mined and worked over by the hand of man, and the iron industry in this country begins to take on more massive and imposing outlines.

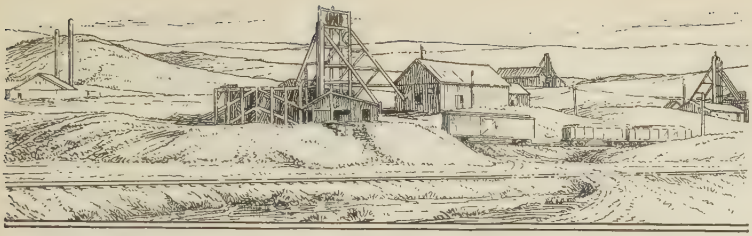
AN IRON-MINING REGION IN MICHIGAN

Advances in production. Huge quantities of the metal have been demanded for huge undertakings. The figures for per capita consumption show, as is natural, an immense rise. The present production of pig iron in the United States is about 35,000,000 long tons, worth over $1,000,000,000. This is less than the value of our wheat crop, but among minerals it is exceeded only by coal. The world's annual production of pig iron is about 70,000,000 tons, so the share of our country in iron production is a large one.

Factors favorable to the industry. Less than fifty years ago the United Kingdom was preëminent in iron and steel production, the United States holding second place but far behind the

leader. It was the development of the Lake iron region and the application of the Bessemer process during the eighties which really established the American steel industry, so that by 1890 the United States surpassed all rivals. And there were other factors which helped considerably: an abundant supply of cheap coke and limestone; machine methods of all sorts; plants of large capacity under a highly economic system; and an adequate home market entirely controlled by home manufacturers. There is no manner of doubt that the above factors have strongly contributed to the increase of the industry, however much one may be inclined to disapprove the presence of certain of them.

The war demand for iron. Here we have infringed somewhat upon the subject of manufacture — for steel, at any rate, belongs to that topic rather than to the present one — and thus have anticipated slightly what is to be said later on. It remains to be noted that the importance of iron deposits came out strikingly in the Great War; the control of such deposits was a bone of bitter contention throughout the struggle. Germany early seized the iron regions of northern France, and it has been stated by a high French official that the enemy, from the very outset, sought to maintain possession of the French deposits, and that the attack on Verdun was for the purpose of confirming and perpetuating this possession. It is estimated that into every acre in the vicinity of Verdun an average of fifty tons of metal — chiefly iron and steel — have been shot, the whole amount being 1,350,000 tons; it has even been proposed to mine it out again. And Verdun is not the only region that is full of metal from projectiles. But all this iron and steel had to be mined somewhere and worked up into proper form. When an idea is gained of the rain of shell on the battle fronts, some conception of the demand upon the iron deposits can be attained. All this looks like gigantic and insane waste, but it is worth the price if benefits that are not material are purchased by losses that are material.



CHAPTER XV

GOLD AND SILVER

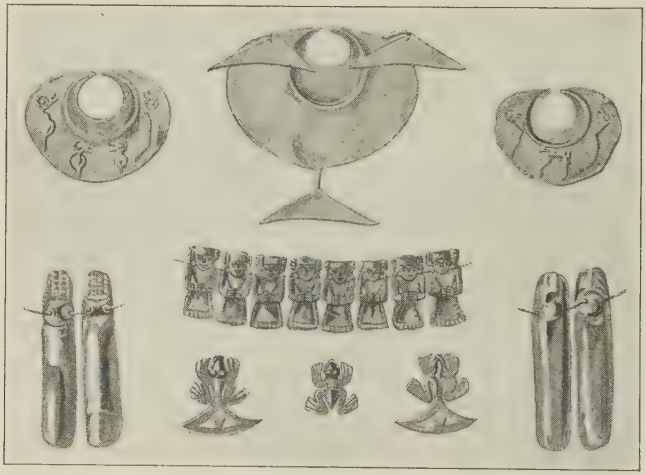
The twin metals. Gold and silver have been mentioned together for many ages as the precious metals; and although there are now a number of more costly ones, these two are still commonly linked one with the other. Both have been used for ornament and both for money. They are still employed for this latter purpose in civilized countries, although for most such countries gold is the standard of value and silver a common coin used for making change.

Gold

Nature of gold. This is a widely distributed metal, being found in almost all countries of the world, as well as in the waters of the sea; it is common in volcanic districts. It occurs in various forms — as veins in quartz, as nuggets, and in so-called "placer deposits" (that is, in small particles, or dust, mixed in with gravel or sand). What called attention to gold was doubtless its attractiveness to the eye of the childlike savage; and it has remained alluring to the discriminating eye of the civilized man. It is also durable, neither rusting away nor otherwise wasting by chemical change. It is said, doubtless with some exaggeration, that all the gold that has ever been mined is now, unconsumed, in the possession of the race, with the exception of that which has, by shipwreck or otherwise, been lost. The metal is also

easy to work, being soft and ductile, and was for this reason a favorite of the savage peoples, who had difficulty with the harder metals.

Gold coinage. Gold is a metal which, because of its softness, suffers much from abrasion; it is therefore ordinarily alloyed with copper or some other harder metal, the grade of fineness of the compound being expressed in carats. For the same reason gold



INDIAN JEWELRY AND ORNAMENTS OF GOLD

has to be alloyed in coins; and it is, indeed, under modern conditions, not very well suited to form a circulating medium. The coins, unless of high value, are too small and are usually a nuisance to carry about, as they are often mistaken, in a poor light, for coins of about the same size but of much inferior value. The gold certificate circulates much more freely and satisfactorily than the gold coin, while for small values silver, nickel, and copper are more convenient.

Indian gold. The Indians knew gold very well and employed it in making trinkets of a more or less crude order, although some of the more advanced tribes had learned to form it into images and

artistic shapes. The natives of Mexico and Peru had great quantities of the metal which were looted by ruffian conquerors like Pizarro; the ransom of the Inca is reported to have been a roomful of gold articles with a total value of some $15,000,000. The Spanish "Silver Fleet" sailed regularly from the Isthmus to Spain with cargoes of precious metals. In fact, it was the consuming desire for the precious metals, joined to the hunger for gain from the spice trade, that led to the voyages of discovery, culminating in those of Da Gama and Columbus. And the Spanish, intent upon such ends, neglected, as we have said, the areas we now call the United States because they afforded no promise in this direction.

ONE OF THE SPANISH "SILVER FLEET"

Increase of the stock of gold. Although gold has been known so long the amount mined previous to the middle of the nineteenth century was comparatively small; the increase at that time was due to the opening up of the mines of California and Australia. There was another increase between 1900 and 1909, but since then the production has been fairly constant. From the standpoint of actual value as compared with other sources of earthly wealth the annual output of gold is small; it is worth less than our wheat, not to mention corn. But it must be recalled that all gold production is a permanent addition to the stock already gathered, and since prices are estimated finally in gold as the standard of value, an increase and consequent cheapening of gold means rising prices.

Processes. The increase of gold has been possible not only because of the discovery of new deposits but also because of the development of processes for the profitable treatment of ores of a lower and lower grade. At first all gold-mining, where it was not merely the picking up of larger or smaller lumps, was placer-mining. The simplest mechanical device for separating gold particles from sand was a pan, in which the sand and gold were shaken

PLACER-MINING

about until the gold, being heavier, sank to the bottom; thus, slowly and painfully, the metal can be separated out. This is called panning. Also a small stream of water, running rapidly down a trough or sluice, on the floor of which cleats have been placed at intervals, can be used. The gold-containing earth is thrown in and the gold settles in the depressions. In real placer-mining banks of earth are broken down by a powerful stream of water from a hose and the earth treated with water to obtain the gold grains. Dredging consists in using an implement not unlike that employed in deepening channels; the earth dredged up is

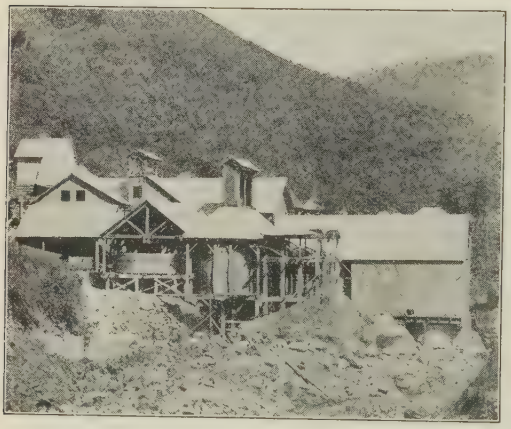
run through sluice boxes. These processes have to do, of course, with gold which has been washed out of its original setting by natural forces; it involves much less investment of capital than actual mining.

Improvement of processes. But when gold-bearing quartz is mined, the masses have to be crushed and the gold collected from the pulverized material. Here is the place where improvement of

PANNING GOLD

processes has appeared most notably. There were formerly inevitable losses in the mining and extraction; much waste material, called tailings, was rejected and cast aside. It is good evidence of the improvement in processes that beds of tailings have been worked over with profit by modern methods of extraction. The process has gone on until it seems that the limit of the lowering of the grade of ore must be approaching, for in some instances two thousand pounds of material are being mined and milled to get one twelfth of an ounce of gold. We cannot expect that the grade of the ore can be lowered much more than this.

Development of the industry. In our colonial times gold-mining was an unimportant industry. The deposits in the eastern part of the country are insignificant, the best being on the Atlantic slope in North Carolina, where, in 1799, a large lump of gold was picked up — the first indication of its local presence. Gradually a few mines were opened and worked in a crude way, but what gold was obtained came chiefly from washings. Later on quartz-mining was pursued to a limited extent, sometimes at great expense but not with a corresponding profit. When the gold mines of California were discovered, these Eastern enterprises were almost entirely abandoned. The average annual value of gold mined in the United States for the decade 1830–1840 was $11,697,000. Then came the California gold strike, in 1849, and the yield for the year 1850 was in the neighborhood of $50,000,000. At present our annual product averages somewhat under this sum, having remained fairly constant during the last few years. California and Colorado are by far the largest producers; South Dakota and Alaska are important contributors. In the preceding figures the Alaskan output is included.



A GOLD-QUARTZ CRUSHER

Silver

The high value placed on silver. Silver is found at times in a native state, but it occurs more commonly in ores along with other metals, such as copper, lead, and zinc. It is therefore not nearly so easily obtained as is gold in the nugget or dust form,

and this accounts for the fact that in remote antiquity silver was valued equally with gold, or even above it. This metal is not so well known among savage peoples as gold. But the American Indians were well acquainted with it, especially the Mexican and Peruvian tribes; the latter had accumulated the vast quantities of it, which, along with the gold, worked so powerfully upon the cupidity of the Spaniards. Immense quantities of silver were looted; later, immense quantities were mined by the conquerors and carried back to Spain in the famous "Silver Fleet." But they did not turn their attention to the lands now known as the United States.

Colonial silver-mining. In some of the Eastern colonies silver in small quantities and mixed with lead ore was found about the middle of the eighteenth century; such a vein was worked with some profit in Massachusetts, and a number of other states in the East once contained rather insignificant silver mines. When the population moved westward, and the large lead-ore deposits of the Upper and Lower Mississippi were discovered, they were found to contain some silver. But this was seldom in paying quantities, for in the earlier days of silver-mining the metal could not be extracted from the ore as readily as at the present time. In 1850, of the silver dollars in use, 99 per cent were of Mexican or Peruvian metal. And the same situation existed with respect to silver plate. Silver had been coined in Massachusetts as early as 1652, but the metal has regularly been an import up to relatively recent years.

Silver discoveries. The amount of silver produced in this country up to 1834 is officially reported as "insignificant"; from 1834 to 1857 its value was $868,000; until 1859 the annual value was less than $100,000. The critical point in American silver-mining was the discovery, in 1859, of the largest deposit in the world. This was on the eastern slope of the Sierra Nevada. Between 1850 and 1860 prospectors had ranged, for the most part on foot, over the whole Western mountain region. They wandered from ledge to ledge, picking up specimens from time to time and cracking them or reducing bits of ore with charcoal

and blowpipe. In the discovery year Henry Phinney and Henry Comstock chanced upon some promising silver deposits interspersed with free gold, and they laid a claim to a mine. Phinney sold out to Comstock for a pinch of gold dust, and Comstock himself soon sold the property. Then it was discovered that marvelous wealth lay hidden away in this claim, and the tidings spread like lightning over not only the United States but the whole civilized world. A period of frantic excitement ensued, such as is described in Mark Twain's "Roughing It," and there followed a great inrush of people and the growth of new large towns, notably Virginia City, Carson City, and Silver City. Nevada was admitted to the Union in 1864, and the Central Pacific Railroad was extended through the region, passing within twenty miles of the point of first discovery.

The Comstock Lode. Between 1859 and 1866 it is said that about $70,000,000 worth of silver was taken from the Comstock Lode alone, and a good deal of gold was associated with the silver. Between 1859 and 1876 about $200,000,000 worth of gold and silver were drawn from this lode, of which about $120,000,000 were in silver. Within a few years subsequent to the big initial discovery silver had been found in considerable quantities elsewhere in Nevada and in neighboring states. The United States at once came to the front as a silver producer; at the present day Nevada, Montana, Utah, and Idaho are the states of greatest yield. In 1890 the famous lode was approaching exhaustion. The population of Virginia City, close by, had been around 11,000 in 1880; in 1908 it was about 2500. If anyone is disposed to doubt the control exercised by natural resources over national destiny, he may reflect that Nevada's silver added a state to the Union and two senators to Congress. Apart from the metallic wealth Nevada's silver regions are a hopeless desert.

Silver a by-product. Taking the world as a whole, at the present time mining for silver by itself is uncommon. It is done in a few special places in Canada, the United States, Mexico, and South America; but the greater proportion of the world's

annual output of silver is a by-product of mining for the baser metals, in particular copper and lead.

Silver coinage. It remains to say a word about the coining of silver. A large part of the world's silver product is minted ; and until towards the close of the last century silver was the principal metal coined in most civilized countries, and was the standard of value in many of them. Owing, however, to the fall in the price of silver due to increased production, there was a wide discrepancy between its coinage value and its value in the open market. Silver remains admirably adapted for small circulating coins. It has also been used in the arts from early times, and finds a place in some of the newer ones, like photography.

CHAPTER XVI

OTHER MINERALS

Lesser minerals. There are several other minerals which are of considerable significance in the economic life of the country but which have not been deemed worthy of separate treatment, either because their advent is too recent for them to have had as yet a very profound influence upon the development of our industrial life or because their importance is one with narrow rather than wide limits. Such minerals are copper, lead, zinc, aluminum, clay products, building stone, cement, lime, phosphate rock, salt, mineral waters, slate, and others. In this chapter we shall briefly touch upon some of the most significant of these.

Copper. This is a metal second only in importance to iron for the industrial development of the country; but that is due chiefly to the fact that it is indispensable where electricity is employed, for, despite much investigation, no satisfactory substitute has appeared. Consequently, although it is a metal that has long been known, the rise of the copper industry on the large scale is rather modern. The metal is widely distributed over the earth, being encountered at times in a pure state, but ordinarily in the form of ores. It is alloyed very commonly with tin and zinc, these alloys forming bronze and brass respectively. Since it can be hammered out without being softened by heat, it afforded to savage man what was, very likely, his first chance to use metal; in any case, it is one of the very oldest metals known and has been used in tool-making and in the arts generally since remote antiquity.

Indian use of copper. Along with other uncivilized peoples the American Indians had discovered the utility of copper; it was the one metal which they had learned to put to practical use. They had even learned to harden copper so as to be able to make implements from it. It was mined in a rude way in the Lake Superior region, the masses of almost pure copper being dug out and raised upon a sort of staging until they could be removed from the shallow shafts. It has been iron and steel that have driven out the copper industry as civilization has advanced; but the Indian, as we have seen, had not arrived at a knowledge of iron.

INDIAN IMPLEMENTS AND ARTICLES MADE OF COPPER

Not much early copper-mining. Inasmuch as copper deposits are scattered widely over this country, even on the eastern slopes of the Appalachians, many discoveries of copper were made in colonial times; in general, however, the comparatively few attempts to work the deposits were abandoned as unremunerative. Copper was found in Massachusetts as early as 1648, and was smelted by imported Swedish workmen; and in 1709 a company was organized to work a copper deposit in Connecticut. The so-called Schuyler mine, in New Jersey, discovered in 1719, was prominent as a producer prior to the Revolution. But our output of the metal long remained small; as late as 1830 we produced not over 50 tons a year, and by 1845 this had risen

COPPER SMELTER — LAKE SUPERIOR REGION

A COPPER-MINING DISTRICT NEAR BUTTE, MONTANA

only to about 100 tons. If these figures be compared with the present yield of over 800,000 tons, some idea can be had of the newness of the industry.

The Michigan deposits. For a long time the Upper Michigan deposits were the great source of our copper; this is a great native copper region, following without a break the axis of

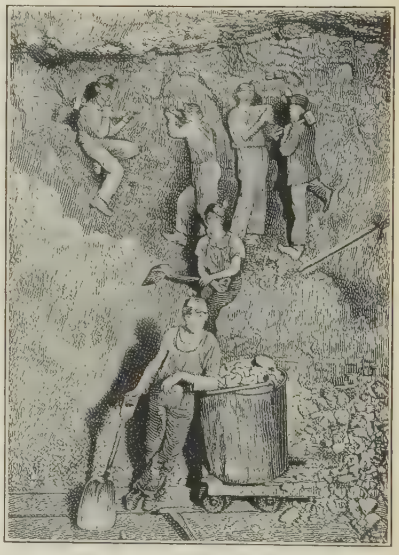
MINING COPPER ORE AT BUTTE, MONTANA

the Keweenaw Peninsula for a distance of seventy miles, with a width of from three to six miles. The Lake Superior region came into prominence shortly before the middle of the last century, largely in consequence of the "copper fever" — a sort of popular furor of 1845 or thereabouts. Stories of the great masses of pure copper to be found in this region had unsettled the judgment of many people, and the shores of the copper peninsula soon teemed with prospectors and speculators. Hundreds of copper-mining companies were formed; but in 1847

PIGS OF LEAD

the bubble burst, and only about a half-dozen of the strongest companies were able to withstand the collapse. The yield of copper had risen from something like 100 tons in 1845 to 650 in 1850, largely in consequence of the opening of the Lake Superior district; but this was only a beginning — the full development of the region came later on.

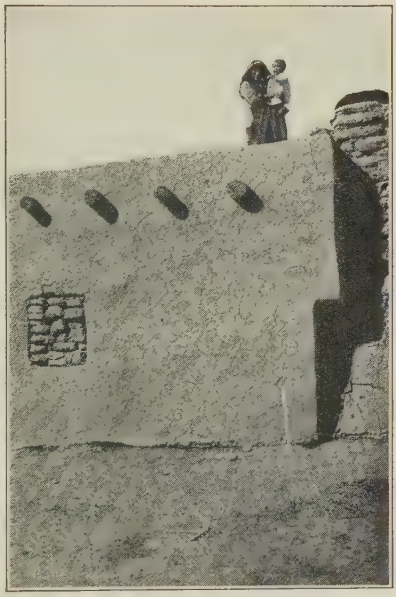
Montana discoveries. Then, toward the close of the last century, came the Montana discoveries, chiefly in the Butte district, and Montana soon came to surpass Michigan; but in 1910 Arizona took the lead. Here, by contrast with Michigan and Montana conditions, the metal comes from a number of different parts of the state. We now lead the world in copper-production.



IN A ZINC MINE

Lead. Lead is seldom found in a pure state, but usually as galena, or sulphide of lead; it is often a by-product of silver production. It has been known since early times, and widely, since deposits are common about the earth. They are common in this country, but although the Indians were familiar enough with galena, there is no evidence to show that they had found out how to reduce the ore to metal. Long before the

Revolution the colonists discovered lead and made attempts to work the deposits. In the eastern parts of the country the results were poor. Lead-mining in Missouri (still a leading state in that industry) began as early as 1720; it is estimated that in 1819 there were forty-five mines in Missouri. At the present time the leading lead and zinc states are Oklahoma, Missouri, and Idaho. The figures for lead production, in short tons, run from 1500, in 1825, to over 600,000 at the present time.



AN ADOBE INDIAN HUT

Zinc. Zinc occurs along with other metals, such as lead and copper. The crude metal is called spelter. Spelter production is a new industry in this country; for although zinc was known to exist in colonial New Hampshire and elsewhere, little was mined, and its systematic and profitable production dates back only a few years. It started in an experimental way in 1858, but statistics of production before 1873 are not available. Thus, as compared with the other metal industries of the country, the zinc industry is of late development. The 7000 tons of 1873 have risen to 124,000 tons in 1900 and to 700,000 tons at the present time. These figures do not take account of the zinc-white derived directly from the ore. The largest use of zinc is in galvanizing iron, but, as is the case with lead, much is used in the manufacture of white paint. The balance is employed in brass making, sheet-zinc making, etc. Many of our states have zinc-bearing ores, but Oklahoma and Missouri lead in zinc and lead production.

Aluminum. This metal also is a newcomer, having reached prominence only two or three decades ago. It is very widely distributed in nature, forming about one thirteenth of the earth's crust; in some rock there is from 20 to 30 per cent of aluminum. The metal has, of course, always been present, but unlike the rest which we have mentioned, it was not discovered until recently and so has no long history. It possesses, however, certain very valuable properties — lightness together with strength, ductility, and electrical conductivity. Were it not for the expense of extraction it would be far more common than it is, but with greater ease in working it, under electrical processes, production is rapidly increasing. In 1883 we produced 83 pounds of aluminum; since then the yield has increased rapidly. When its price, as compared with that of iron and copper, is sufficiently reduced, aluminum will doubtless be used extensively as a substitute for them, for it has the necessary qualities; and the price of copper, at least, is now not so far from that of the newer metal. One of the main superiorities of aluminum is its lightness; the need for a strong, light metal for use in automobiles, and especially in the manufacture of aëroplanes and other flying machines has raised a considerable demand for aluminum. This metal alloys with others rather easily, and it strongly resists the influence of water and vegetable acids; it is therefore especially adapted to

A POTTER'S WHEEL

the construction of kitchen utensils and surgical goods. It is now used for many seemingly inconsistent purposes, such as machine bearings, fancy articles, jewelry, and (a utility as yet only in its beginnings) the decoration of interiors — it supplants wood, for example, in modern business offices.

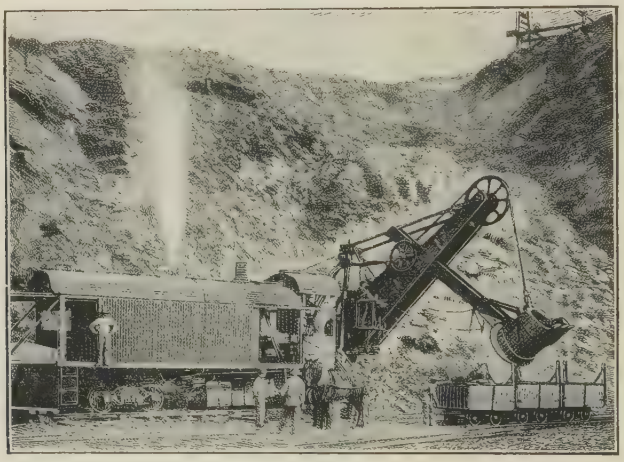
Clay products. Clay formed an obvious material for the manipulation of early man, and he formed it into many sorts of utensils, as well as into bricks for house construction, which were at first merely sun-dried (adobe). Probably by accident he early discovered

DISH-MAKING; PUTTING HANDLES ON DISHES

the possibility of baking and so of hardening the clay, and then the way was open to hard brick and pottery. In the course of time the several varieties of clay were discovered, and wares were manufactured that ranged from the coarsest brick to the most delicate porcelain.

Value of the clay industries. Clay beds are, of course, well-nigh universal; they are so, in particular, in this country. They differ much in grade of product, being fit for, say, brick, tile, or pottery. The American Indian was a great pottery-maker, but in a rude way, for he did not know of the potter's wheel. In early colonial days there were small potteries in all the colonies. And the first manufactory of white ware was in Burlington, New Jersey,

but the pottery industry was not firmly established here until after the Revolution. At present the annual value of our clay products is between $200,000,000 and $365,000,000; for many years the brick and tile products have constituted about four fifths of the value of all clay products, the other fifth being pottery. In money value the clay products stand, among the nonmetallic minerals, next to coal and petroleum. Bricks and tiles are of the most

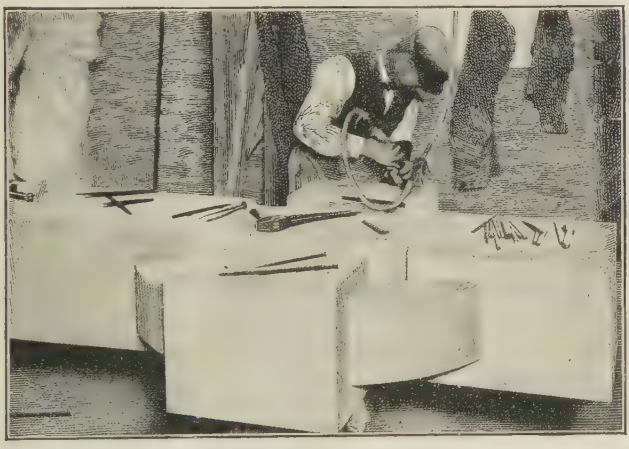


STEAM SHOVEL LOADING CEMENT ROCK ON CARS

consistent utility in structural work; the clay industry goes up and down with building operations. Ohio and Pennsylvania figure most prominently in both general branches of the clay industry.

Stone. An important natural resource of the United States is the variety and abundance of its stone — stone adapted to building and to other important purposes. The principal stone quarried are limestone, granite, marble, basalt and related rocks, and sandstone — limestone representing over 40 per cent of the total value of the annual output and granite about 25 per cent. The leading states in production are Pennsylvania, Vermont, New York, Ohio, and Indiana.

Development of the stone industry. Despite severe competition with artificial-stone products the stone industry as a whole has advanced as the country has developed. The use of cement has damaged the production of the lower grade of stones — foundation stones, for example — but it has not much affected the higher grades used in building and still less those employed in monumental and ornamental work. In fact, the use of concrete and the

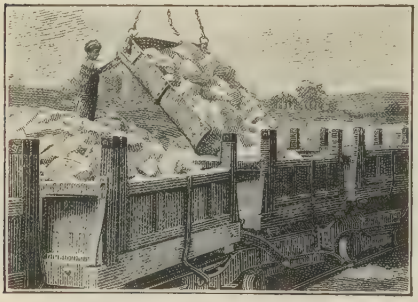


USING AN AIR-DRIVEN CHISEL TO CUT A BLOCK OF GRANITE

extensive building of roads and railroads has stimulated the crushed-stone industry to such an extent as to more than offset the decline in other kinds. Sandstone production alone shows a consistent decrease. It advanced considerably with the building of numbers of railroad bridges and other structures, from 1897 to 1903, but since the latter date its use for building purposes has suffered from competition with cement as well as limestone, and it is not well adapted for use in the crushed form.

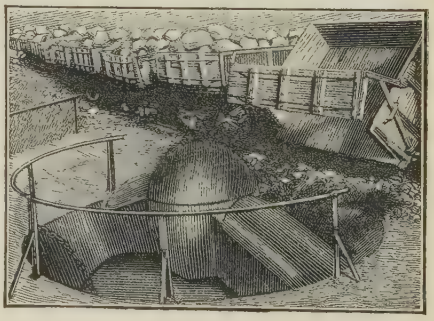
Cement. There are three principal types of hydraulic cements — natural, Portland, and puzzolan. The first is sometimes called Roman cement, and is obtained by treating a certain type of limestone. This cement was first used in England in 1796. In the

United States "cement rock" was discovered in New York State during the building of the Erie Canal in 1818, and cement made from it was used in building the locks and walls of the canal. Portland cement is a more complicated product named from some resemblance shown by it to a sort of limestone found on Portland Isle, Dorsetshire, England. Puzzolan cement when made into mortar has the property of hardening under water; it has been used in Italy since very early times. The annual value of these three varieties of cement is, for the United States, upwards of $250,000,000, most of which is to be credited to the Portland variety. The use of this material is rapidly increasing, extending even to the "pouring" of a house in molds.



LOADING LIMESTONE

Summary. It is apparent that our country leads the world in the production of most minerals. There are only a few in which we are deficient or wholly lacking, the most important being platinum, nickel, and tin. Our minerals are genuine natural resources, for they were placed here by the forces of nature and cannot be imported into the ground, propagated, or otherwise manipulated by man except as he may dig them up and use them. It may be said that this country possesses not alone a rich soil but also a rich subsoil.



UNLOADING LIMESTONE INTO THE TOP OF A MAMMOTH CRUSHER

PART V. MANUFACTURING INDUSTRIES

CHAPTER XVII

ADVANTAGES OF THE UNITED STATES FOR MANUFACTURING, AND THE LOCALIZATION OF INDUSTRIES

The working up of natural materials. Scarcely any product of agricultural, animal, or mineral industry is ready for the use of man until it has been reshaped or transformed in some way. The hand of man has to be set to this task, and the result is a manufacture — something made by hand, as the Latin derivation of the word indicates. We could not help referring to such fashioning over of materials in what we have already said: the cereals have to be ground, the sugar refined, the cotton spun and woven, the animal products worked up in various ways, the minerals gotten from the ore and shaped, the crude oil relieved of its impurities and other unpleasant qualities.

Antiquity of manufacture. Of course man has been at work for all his time on earth setting his hand and brain to the task of making the most out of what he has gotten from the soil. Manufactures go back so far that some authorities think the chief distinction between man and the lower animals is that man is the "tool-using animal" — a tool being really any form of instrument used in adjusting materials to human use. A history of human manufacture would be a history of the human race.

It would be a technological encyclopedia in many volumes. In this book we shall have enough to do if we start at once with our own country and the modern age.

Development of our manufactures. In general, down to the middle of the nineteenth century — a landmark in our industrial history to which we have had occasion to refer over and over again as the starting-point of this or that extractive industry — the value of the manufactures of this country was comparatively small. Agriculture was the chief occupation, and most of the articles required by the mass of the people were made in their homes, while the wealthier classes were supplied in large part by the importation of manufactured wares from other lands. The factory system, which secured a hold in England at the close of the eighteenth century, did not become generally established here until the second quarter of the nineteenth century. The development of our manufactures on a very large scale has, in fact, taken place since 1880. Numerous causes, into which we shall go further later on, have helped to produce this result; they are increased supplies of raw materials produced here, increase of population, improved transportation, increased purchasing power of the masses, and increased foreign demand for our manufactures. At the present day we lead the world as a manufacturing nation, but our home market is so great, because of our vast population, that only a small proportion of our total manufactures is exported. The industries of the country are now very numerous and are coming to be more and more widely scattered over the land, but the northeastern and north-central regions are the two typical manufacturing areas. On the basis of value of manufactured products the five leading states are New York, Pennsylvania, Illinois, Ohio, and Massachusetts. Taken together, these states produce half of all the goods manufactured in the United States.

Value of our manufactures. The annual value of the products of our manufacturing industries amounts to about $61,000,000,000. The output of our manufacturing plants has more than trebled within a period of less than two decades. The largest group of

ANNUAL VALUE OF PRODUCTS MANUFACTURED IN EACH STATE

After diagram in *Abstract of the Census of Manufactures*

manufactured goods comprises food and kindred products, and in this class slaughtering and meat products constitute the largest items, followed by flour and gristmill products; the textile industries, among which cotton manufacture takes the first place, come second; the third class in value of output consists of iron and steel and their developed forms; and chemical and allied products rank fourth. The following table, adapted from a recent Census of Manufactures, exhibits some of the most striking facts about our recent manufacturing development:

	1919	1909	1904
Number of establishments	290,105	268,491	216,180
Persons engaged in manufacture	10,812,736	7,678,578	6,213,612
Proprietors and firm members	269,137	273,265	225,673
Salaried employees	1,447,227	790,267	519,555
Wage-earners, average number	9,096,372	6,615,046	5,468,383
Primary horse power	29,504,792	18,675,376	13,487,707
Capital	$44,466,593,771	$18,428,270,000	$12,675,581,000
Salaries and wages	13,425,771,834	4,365,613,000	3,184,884,000
Salaries	2,892,371,494	938,575,000	574,439,000
Wages	10,533,400,340	3,427,038,000	2,610,455,000
Cost of materials	37,376,380,283	12,142,791,000	8,500,208,000
Value added by manufacture	25,041,698,490	8,529,261,000	6,293,695,000
Total value of products	62,418,078,773	20,672,052,000	14,793,902,000

Causes of our success. We have stated these remarkable and even startling facts and figures at the outset, in order to show that there is here something deserving of description and of explanation. The world has never seen anything like this before. Here, three hundred years ago, was a raw country; but there have been other raw countries that have had no such industrial development. Something beyond the mere newness of the land was operating in this case. Wherein lay the causes of such an unparalleled success?

Our rich resources. Some of these causes we have already encountered, namely, the agricultural and mineral resources. There are in the United States, as we have already seen, abundant food supplies of almost all sorts and abundant raw agricultural materials; thus are the consumer and the manufacturer satisfied. As for minerals, this country contains supplies of almost all that are

MOVEMENT OF IRON ORE FROM THE LAKE SUPERIOR PORTS TO THE FURNACES

After map by United States War Department

required for the development of manufactures. It is particularly rich in coal and iron, the great essentials; and this coal and iron, together with the limestone needed for smelting, are to be found either in proximity or so located that easy transportation routes connect them. Iron deposits, for example, are at one end of the Great Lakes, and coal at the other; but, largely for the purpose of assembling them, there exists on the Great Lakes the cheapest and most efficient system of water transportation to be found anywhere in the world. Agricultural and mineral

materials for manufacture are cheap and can be taken with little expense to places where they are wanted.

The transportation system. This leads us to speak of the transportation system in general; we shall describe it more specially later on. Our facilities in this line are exceptional, notably in the most heavily populated regions, where are the seats of manufacture. Not only can we assemble materials readily but we can also get products to market easily and quickly. Most of the important manufacturing regions are on the seaboard, or salt water is accessible to them. As early as 1899 the freight traffic of the Great Lakes had become so large that they became the foremost internal waterway in the world, and the traffic was so heavy that more than five times as many vessels passed through the Canadian and American "Soo" Canal as through the Suez Canal. Of the railway system it is enough to say, for now, that it reaches the most remote regions of the country and shows a mileage far exceeding that of all European countries combined. Freight rates are comparatively low, so that here again is an element of cheapness to encourage production.

Freedom of trade. It is readily seen that ease of movement of products is a great feature in encouraging production. But in addition to unrivaled transportation facilities we are, in this country of about three million square miles and over a hundred million souls, without any commercial barriers. There are no frontiers to be passed between the Atlantic and Pacific — three thousand miles. This is the largest area in the world which is free and unrestricted by customs taxes or national prejudice. We are all one nation, and trade within our wide boundaries is free. This fact alone accounts for much in our industrial development which could not otherwise have been.

The demand for our manufactures. Thus we have had the natural resources, the opportunity to move products about freely, a quality of population able to adapt itself to new situations — especially through its inventiveness — and also markets for whatever we could make. When we had little but forests, these were in

demand in the countries with which we came most into contact — England, the West Indies, Southern Europe (England being always ready to buy our naval timber and stores). But a word more remains to be said about our population.

American progressiveness. We have said that America was long a frontier society. That meant, among other things which we have mentioned, that the colonists here were enabled to bring over what they chose of the European system and also to reject whatever there was in that system that did not appeal to them. Since many of the settlers migrated because they were dissatisfied at home, they readily left behind them the ideas that had irritated them. The whole situation, as we have seen, was calculated to make them independent and fond of doing their own thinking in their own way, and they fell into a national habit of striking out on new paths. We entered, therefore, upon our industrial course unfettered by the old order of things and with a tendency to seek out and adopt the best and quickest ways.

American adaptability. In the European countries the development was, so to speak, step by step and reluctant. People had become accustomed for generations to fixed methods of work, in which they had developed a high degree of skill, and they would not readily abandon them in favor of new ones. In Europe it was natural for the artisan class to resist the introduction of machinery into those trades by which it lived; and so hand processes of manufacture persisted side by side with machine methods, whereas in the United States the machine easily usurped the whole field. For in this country the artisan showed no "inherited and intuitive adherence to old-fashioned methods," but a tendency, rather, to abandon hand processes and take up machine methods. The frontier society advances by longer strides, covering in a few hundreds of years at most the distance from the raw and crude to the civilized and polished. Likewise the laboring classes here have illustrated a marked mobility of labor unknown in other parts of the world and for this reason it is possible to attract to almost any region of the country the skilled labor necessary

to develop any branch of industry. Consequently, when there were enough people here so that a factory system could be developed at all, it appeared promptly, and there was no great wrench in the life of society or of the laborers.

Independence of American labor. Also it must not be forgotten that in America there were no cut-and-dried social distinctions. In parts of Europe a son was almost or quite sure to follow his father's profession; he was expected to do so, and not to try to thrust his head up among his betters. But here there was little to prevent a man from roving about from one occupation to another; the traditional character of the "Yankee" is that of a nasal-voiced, wood-whittling person who refuses to be surprised at anything and who can set his hand to any job that turns up. Something of this character has been impressed upon the nation.

Civil liberty. And, finally, the influence of our form of government, with its ideals of freedom and equal opportunity for all men, has not alone allowed those who were here to live out their lives under a liberty greater than men have ever enjoyed before, but it has attracted to us men and women with mind and heart enough to appreciate and want such liberty. Our free government, unhampered business organization, highly developed educational system, and social system in general have all contributed to our industrial successes. Men living under such conditions develop hope and confidence; they succeed, and then push forward again with renewed energy—for "nothing succeeds like success." American industrial pioneers have learned to dare greatly.

Importance of these social virtues. We have laid considerable stress upon these personal and social advantages enjoyed by our population, both here and in a preceding chapter on "The Human Element," because we believe that the common practice of referring American successes to natural resources, with comparatively little said about the quality and state of mind of the people, represents a decidedly narrow or careless outlook upon our situation. It is the men as well as the things that must be counted in if one is to get a clear idea of American industrial development.

Localization of Industries

Factors determining localization. Having viewed some of the broad, general reasons for American industrial growth, a question now emerges. Granted that the conditions of land and population made such industrial development inevitable, why are the centers of industry in general, and of this and that industry in particular, located as they are, and not otherwise? To this question the "Report on Manufactures" in the Twelfth Census gives an answer which will serve as a good basis for our study. The reasons why a manufacturing industry is situated in one place rather than another are stated to be as follows: (1) nearness to materials; (2) nearness to markets; (3) presence of water power; (4) a favorable climate; (5) a good supply of labor; (6) presence of capital available for investment; (7) the momentum of an early start. The first six of these items combine to limit broadly the area within which it is economically possible to develop an industry; but, as the last item indicates, the exact place within this area where the industry takes root is very often determined by the influence of some pioneer whose personal interests have caused him to fix upon some special spot. Then if it chances that such an industry is successful, it soon gains a momentum strong enough to enable it to continue in the original locality, sometimes for a long period after the advantages which it once possessed have disappeared. We shall now take up briefly the seven items just mentioned as determining the localization of an industry and, in particular, of a manufactory.

Nearness to materials. This item, as well as most of the rest, requires nothing but illustration to make it clear. The paper industry developed near the spruce and poplar forests; the tanning industry near the tanbark and other tanning materials; slaughtering and meat-packing developed near the stock-raising centers; agricultural implements were manufactured near the hardwood forests and the iron-producing centers; the glass industry located near its fuel — natural gas in particular; the iron industry sticks

to the coal region. Now if one could by magic transfer heavy bodies instantaneously from place to place, this item and the next one would disappear from our list — a munition manufacturer would not remain the year round in Bridgeport, Connecticut, but would take his business to the Maine coast or the White Mountains during the hotter months. The fact is that both these items mean saving of transportation costs, and the cheaper and swifter the transportation, the less powerful are these conditions of localization.

Nearness to markets. The market for products is found where men are — there is little market for anything in the Desert of Sahara. If one notes in the Census Atlas the movement of the center of population for the country, since about the middle of the last century, let us say, he has already noted thereby the general movement of the center of manufactures. A large percentage of the manufacturing of this country is carried on in states of dense population, such as New York, Pennsylvania, Massachusetts, Illinois, and Ohio; these five states contain about one third of the population of the United States and produce about half, on the basis of value of our manufactured products.

Water power. This is the one powerful force in nature which can be employed in man's operations almost directly — as compared, for example, with heat and electricity. It is not necessary to transport water power, and so the manufacturer with it at his disposal has an important advantage over the one who uses coal. Before the days of steam the influence of available water power for the localization of manufactures was still more decided; and this early impetus, combined with other forces, has tended to hold such industries in their original locations, even when steam as a source of power has become more important than water. New England had numerous rapid rivers, so that water power gave this section, especially in earlier times, an advantage in securing manufacturing eminence. The location of plants along the well-known "fall line" has been referred to in a preceding chapter.

Favorable climate. Where the climate is too warm the workman sacrifices efficiency; and the same is true of the other extreme, in addition to the fact that costs for heating have to be incurred. Much sunlight, again, saves illumination. The influence of a moist climate, with temperature fairly even throughout the day, was a factor favoring New Bedford and Fall River for the cotton-spinning industry. Recently investigations have been made concerning the influence of climatic and weather conditions upon labor efficiency, and it is found that extremes either of heat or cold tend to lessen the efficiency of factory operatives. When competition shall have become keener, reducing margins of profits within narrower limits, it may well be found that the factor of climate is much more significant for industry than we have hitherto imagined. Man is always an animal, made of flesh and blood, and it is not to be expected that he can emancipate himself from the influence of this factor, so powerful over all animal life.

Labor supply. Manufactures are made for men, not men for manufactures; but without the men in sufficient numbers there are no manufactures. The virtual coincidence of the center of population and the center of manufactures, of which we have spoken, is due also to the dependence of industry upon workmen. An industry requiring thousands of laborers in a single plant cannot exist in a sparsely settled region. American labor is mobile, as we have pointed out, but not indefinitely so. The labor draws the industry, as well as the industry the labor. Manufactures regularly are established in sections where there is a good supply of labor near at hand. Here is where the New England towns have had a great advantage. They were surrounded by farms which had reached the point of exhaustion and could employ only a small number of the young men and women. The surplus labor moved naturally to the towns, and the early development of manufacturing was thereby favored. For a similar reason no extensive manufacturing plants can be located in those parts of the West where the additions to population are absorbed for the most part in a still incompletely developed agriculture.

Different industries in different sections. The result, in a big country like this, is that different sections are likely to specialize in different industries, thus supplementing one another; and the fact that this is the case, plus the fact of interior freedom of trade, furnishes yet another good reason for our general preëminence in industrial lines. Nor must the copious stream of immigration into the United States be left out of account as contributing powerfully to our labor supply, and so to our manufacturing supremacy; but the immigrants tend to settle in the northern and eastern sections of the country, and so to influence the localization in these sections of plants demanding a large labor force; that is, the large manufacturing plants.

Supply of capital. Much capital is required for the building of factories and the setting up of machinery. The day of the single owner or of the limited ownership of industrial plants has gone; it needs the combined capital of many men to establish and operate a modern factory. But locally owned capital has always been an important factor in the development of American industries. Now some of the largest enterprises are financed from big financial centers remote from the place where the plant is located; but many of the smaller concerns, and almost all of the earlier ones from which the contemporary industries have developed, have been financed by people on the ground. For example, a good deal of capital was set free in New Bedford by the decline of the whaling industry, and this was utilized, in good part, about the middle of the nineteenth century, for the establishment of cotton manufacture. A Siamese prince may now own shares in a New Bedford cotton mill, but the mill is in New Bedford because originally it was New Bedford people who put their money into it. Southern cotton mills also have been financed in large part with the capital of local townspeople.

Knowledge of local conditions. In many instances capital has been raised outside, but even so it can be obtained more easily after the men on the spot have expressed their confidence in the undertaking by investing in it themselves. People like to have

good evidence as to the nature of the enterprise into which they are putting their capital, and there is no evidence so reliable as personal knowledge of the character of the material prospects and of the men who are to do the directing; and these you get by close acquaintance with both.

The momentum of an early start. This point is closely connected with the last one. Let the conditions be good and let the local people put up the capital, and presently the industry gathers such headway that it is hard to overtake. The preceding factors explain the localization of industries within certain broad areas, but they ordinarily fail to account for the marked concentration of certain industries within a single town or city. As we have remarked, it was often the personal reason, or lack of reason, of the pioneer in the industry in question that did the business, he chanced to be in a certain place, not obviously unfitted for a certain industry, when he conceived the idea of starting it. Many industries continue where they were established, even though there are dozens of other localities where the product could now be made with equal, or even superior, advantage. We propose to illustrate this factor of the early start at some length; it looks like chance, for it is not easy to penetrate into the circumstances that led the pioneer to make his start where he did; in any case, there were miscellaneous reasons in the minds of many pioneers — too miscellaneous, perhaps, to classify.

Boots and shoes at Lynn. The boot and shoe industry of Lynn, Massachusetts, is a case in point. A certain skilled shoemaker chanced to settle in Lynn. He made better shoes than his competitors, and ended by making the boot and shoe industry of the town. Lynn was famous for its shoes as early as 1764; but had this man settled in Dedham rather than Lynn, the former town would probably occupy to-day the high position in this industry actually held by the latter.

Collars and cuffs at Troy. Take, again, the manufacture of collars and cuffs, an industry which shows the greatest concentration of any in the country. Troy, New York, manufactures

about 90 per cent of all the men's collars and cuffs made in the United States. Now it was nearly a hundred years ago that the making of collars started in Troy. At that time it was the fashion to make the shirts with collars attached, and the manufacture of separate collars was a novel departure. It is said that a retired clergyman of Troy, who owned a small dry-goods store, conceived the idea of making and selling the separate collars; his wife

INTERIOR OF A BOOT AND SHOE FACTORY AT LYNN

and daughters made them by hand and starched and ironed them on the kitchen table. These collars sold as fast as they could be made; and it was not long before the manufacture of separate collars and, later, of cuffs — and then of shirts as well — became an important local business.

Firearms in Connecticut. Connecticut is preëminent among our states in the manufacture of firearms and ammunition. Here, again, there was an early start, for Eli Whitney, inventor of the cotton gin, was one of the earliest makers of firearms, beginning

his operations in Whitneyville early in the last century. In 1814 pistols were being made in Middletown, and before the middle of the century Samuel Colt, another inventor of firearms, had built factories in Hartford costing half a million dollars. In this state various other arms and munitions were being made in large quantities before the Civil War, and it has continued to preserve its advantage. At the time of the Spanish War, and again

INSPECTING RIFLE AMMUNITION

in the Great War of our day, it has been supposed by some nervous people that an enemy would certainly strain every point to make a successful assault upon Bridgeport or New Haven. There is no particular reason for such localization of the manufacture of arms and munitions except that they started early and met with success.

Other cases of specialization. Further illustrations of concentration of industries reveal the operation of several of the factors instanced above, in addition to that of an early start. In a recent Census of Manufactures of the United States fifty industries were selected to illustrate this concentration in varying degrees.

Thus, 86 per cent of the artificial flowers and plumes were being made in New York State; 63 per cent, on the basis of value, of the automobile product was contributed by Michigan; Massachusetts still continued to produce close to half of the boots and shoes of the country; Connecticut made over 40 per cent of the brass, bronze, and copper products; New York and Pennsylvania, taken together, manufactured over 70 per cent of the carpets and rugs; New York, about 70 per cent of the fur goods, leather gloves, and mittens; Pennsylvania and Ohio, together, about 70 per cent, on the basis of value, of the output of blast furnaces, steel works, and rolling-mills; Pennsylvania and New Jersey, over 60 per cent of our silk goods; Illinois, about 30 per cent of the product of slaughtering and meat-packing; and Louisiana and Texas, together, nearly 90 per cent, on the basis of value, of the rice-cleaning and rice-polishing industry.

Specialization by cities. With respect to the concentration of industries in particular cities, it may be said that according to a recent investigation Detroit, Michigan, was making over 25 per cent, on the basis of value, of the automobiles of the country; Philadelphia, 30 per cent of the carpets and rugs; New York City, a third of the men's ready-made clothing, over 70 per cent of the women's clothing, and nearly the same percentage of fur goods; Gloversville, New York, a third of the gloves and mittens; Paterson, New Jersey, one fifth of the silk goods; Chicago, a quarter of the slaughtering and meat-packing products. Some of these cases can be briefly accounted for. The manufacture of ready-made clothing is concentrated in New York City largely because of the abundant supply of cheap immigrant labor that settles or is stranded there, because New York is an important port of entry for the materials used, and because New York received the impetus of an early start, the industry beginning there about 1830. And, again, hosiery and knit goods were manufactured in Philadelphia as early as 1698, and in Cohoes, New York, in 1832. The early start of Philadelphia was due to the immigration and settlement of a large number of skilled

hand-knitters from Europe, while Cohoes received a strong stimulus in 1832 from the local invention and application of the first power knitting-machine in the world.

It is hardly worth while to pursue this topic of the localization of industries any further here; we have now the general reasons and some examples of the special ones. Whatever else is needful for an adequate understanding of the subject will appear as we survey the several manufacturing industries by themselves.

CHAPTER XVIII

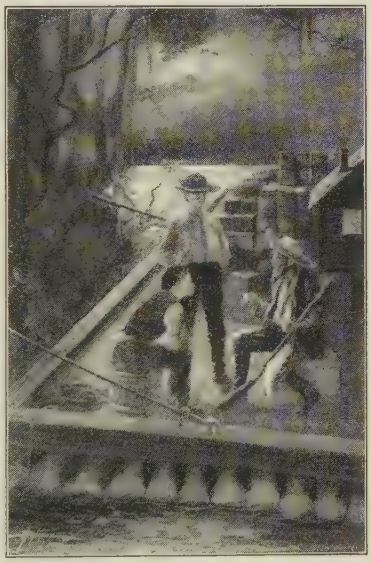
FOOD AND KINDRED PRODUCTS

Importance of the food industries. This group of industries embraces the manufacture of all kinds of food products except liquors and beverages. Of the fourteen leading groups of American industries distinguished by the Census Bureau this is the most important, judged by the annual value of its product; for the various industries here included produce a value of close upon $10,000,000,000 a year. The simplest classification of these industries is into (1) the manufacture of animal products and (2) the manufacture of vegetable products. There are numerous special industries under each of the two general heads, for the description of all of which several large volumes would be insufficient; we shall select outstanding examples from each of the two.

Early slaughtering and meat-packing. From the standpoint of value of product the slaughtering and meat-packing industry is now the most important in the first group; and it finds its greatest development in the killing, curing, and packing of hogs, although the similar treatment of cattle and sheep is no small enterprise. Naturally pork-packing came out of the original domestic industry, if it might be so called, of filling the local pork-barrel for the family use. Shortly before 1700 Boston was doing a considerable business in curing pork and packing it in barrels.

The westward movement. Then the Middle West began the industry in 1818, at Cincinnati; it does not seem to have taken

root in Chicago until several years later. In the winter of 1832–1833 Cincinnati slaughtered 85,000 hogs. When, now, the agricultural resources of the Middle West started in their development, there was plenty of food, especially corn, for the domestic animals, and farmers observed the profit to be gained by raising hogs for Eastern and Southern demand. Of this something has already been said. And the fact that shipping required water transportation caused the industry to settle on the rivers; goods went to market by way of the Ohio and Mississippi rivers, even when the final destination was Baltimore, Philadelphia, New York, or Boston. It appears that the river flatboat was not seldom the real packing house, as the curing was done on board while the meat was on the way to market; or, more often perhaps, the curing was done on board the boats in winter so that the meat would be ready for marketing when the spring thaws freed the river for navigation. The cured product was often sold to merchants located at strategic shipping points, such as St. Louis and New Orleans, in exchange for merchandise such as rice, sugar, and molasses, which were much in demand in the up-river country.



DOWN THE MISSISSIPPI BY FLATBOAT

Concentration at Chicago. For the decade 1842–1852 Cincinnati packed over a quarter of the total pork of the West, reaching a figure of 475,000 hogs slaughtered in 1848–1849; but soon thereafter the railroads penetrated the West and, since markets now became available independently of waterways, changed the geographical position of the industry. In 1850–1851 Chicago

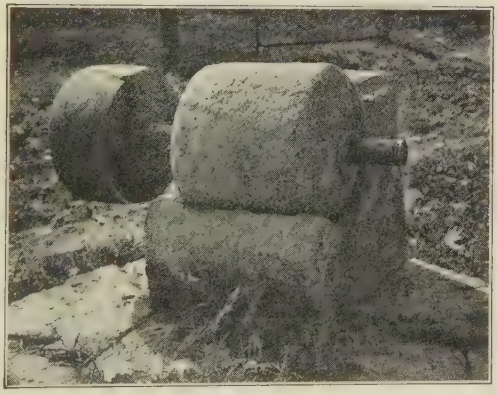
slaughtered 20,000 hogs and afterwards developed the industry very rapidly; Cincinnati held first place till 1861–1862, after which Chicago was not to be overtaken. Thus the center of the industry, having been in the Ohio Valley, moved westward to the great stock-raising centers. It is much cheaper to send packed meat to distant markets than it is to assemble the animals for slaughtering at points nearer the consumers, but which may be a thousand or thousands of miles from the animal-raising districts. This industry thus adapted its location to considerations of comparative cost of production. The development throughout the country has been strong; about sixty years ago the capital invested in the business was only $3,500,000, while to-day it is over $1,500,000,000. The industry has reached such enormous proportions that the annual value of its product is $2,500,000,000, it supports nearly 133,000 wage-earners, and there are over 1300 establishments.

Rapidity of the processes. Labor-saving devices have been perfected to a nicety; the killing is still done by hand, but there are, as we have already seen, many ingenious devices for handling the carcasses. The animals are prepared for the chill-rooms at the rate of about twenty a minute. The factor which, perhaps more than any other, has stimulated the packing industry in the last few decades is the development of the process of artificial refrigeration. The carcass has to be properly and thoroughly chilled; but the packing season is now twelve months long, summer-cured meat differing in no essential respect from winter-cured. The problem of so cutting up the animals as to cater to the peculiar tastes of the numerous sections and nations to which the packing products are sent is a matter demanding considerable study and care. As in pork-packing, so in beef-packing, the refrigerating methods, and especially the refrigerator car, have been of great significance; meat handled by way of refrigeration is in far better condition than the product which the packers used to provide years ago, when living animals were shipped by rail for two thousand miles or so.

Elimination of waste. In the packing industry as a whole waste has been rigorously eliminated, and allied industries have developed in connection with the packing houses. "The fierceness of competition," says an expert, "may force the packing house of twenty-five years hence to include a tannery, a boot and shoe factory, a cloth mill, and a mammoth tailor shop."

GRINDING FLOUR IN A HAND MILL

Flour manufacture. So much for a typical and ranking animal-food industry; we come now to the manufacture of food from vegetable products. Here we have selected the flour and gristmill production as the most important, measured by value of output, and as a basic form upon which many others, such as baking, rest. At the present time flour and gristmill products reach an annual value of more than $1,000,000,000; there are 35,000 wage-earners employed in making them. Our enormous cereal crops have given rise to an extensive milling, and each advance of grain production has been followed by a corresponding increase of machinery and establishments for its manufacture.



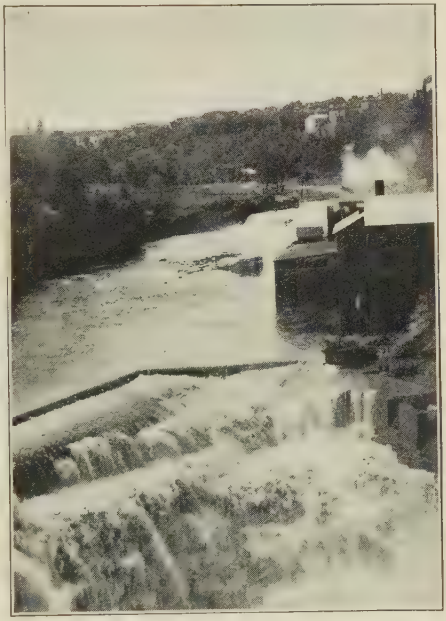
AN EARLY NEW ENGLAND MILL-WHEEL USED FOR GRINDING GRAIN

Development of milling. The first way of milling grain was with the teeth, — the large back teeth, which we still call grinders, or molars, — but it was not long till men came to use two stones for the purpose. They have used two stones up to recent times and have not by any means given up this method even yet. The first flour mill in American history was the hand mill — two small stones, one fitted with a handle so that it could conveniently be rubbed on the other. But in early colonial times there were gristmills run by wind power. These were usually subject to toll laws, which established the charge for grinding grain; thus, though the rates were not uniform, in New England the toll was usually one sixteenth of the wheat and one twelfth of the Indian corn ground. Bolting, the process of sifting the crushed grain, was ordinarily done in the home. In the South very high tolls were exacted; in Maryland in early times the toll was one sixth of the grain. Later on, the water mill succeeded the earlier devices, and flour became, even as early as the latter part of the seventeenth century, a considerable export.

OLIVER EVANS

Milling centers. The flour mills of Delaware on the Brandywine were very celebrated in the period succeeding the Revolution. Twelve such mills, with twenty-five pairs of stones, ground 400,000 bushels of wheat per annum. The town of Wilmington was exporting 20,000 barrels of superfine flour a year. There were 130 mills within a radius of forty miles, and contemporary opinion had it that the manufacture of flour was carried to a higher degree of perfection on the Brandywine than in any other state in the Union. Baltimore also became prominent in early times as a milling center; in 1769 she exported 40,000 tons of flour and

bread. Baltimore flour was regarded as of superior quality, and that city was the first milling point to adopt the mechanical improvements devised by Oliver Evans, who, about 1785, by the introduction of the elevator, conveyer, and other mechanisms, combined the various stages of the process into a continuous system, dispensing with half of the labor formerly required and enabling the miller, by machinery alone, to take the grain through "from wagon to wagon again." Next to Delaware and Baltimore came Richmond, whose flour was in great demand in both home and foreign markets until relatively recent times; in 1845 the mills of Richmond included the largest in the country and their flour commanded the highest prices. The great market for Richmond flour was in South America.



GENESEE FALLS — ROCHESTER, NEW YORK

The fame of Rochester. Rochester and the Genesee Valley sprang into fame for their flour production nearly a century ago and attained and held celebrity on two continents for a half-century. Genesee Valley flour repeatedly took prize medals at European expositions. Rochester was favored for production by the fact that the Genesee River had, within the city limits, successive falls aggregating 268 feet; also the Erie Canal, the Genesee River, and the railroads brought to the Rochester mills not only the local wheat of the famous valley but also that of Ohio and Canada. Within twenty-five years after the War of

1812 Rochester erected twenty-one flour mills, with a daily capacity of 5000 barrels. In 1860 there were nineteen mills, with a yearly product valued at $2,500,000. Rochester continued to be the Flour City of the continent until the growth of its nursery business caused it to be denominated the Flower City.

Westward movement of milling. With the Western movement of the grain production there went a corresponding migration of the milling industry. As early as 1840 Ohio, Kentucky, Indiana,

EARLY SHIPPING SCENE ALONG THE ERIE CANAL

Illinois, and Michigan together produced 2,000,000 barrels of flour, which constituted about 30 per cent of the total output of the country. Twenty years later the Western states, so called, were producing more flour and other milling products than the New England and Middle States combined. New York was still the leader in value of flour produced, but Ohio stood second, and half or more of the flour manufactured in the United States was produced west of the Alleghenies.

Routes of shipment. Long before the flour-milling industry developed in the Northwest, cities like Cincinnati and St. Louis were active, for the first trend of flour production toward the West was down the Ohio River; a steam flour mill was in operation

in Cincinnati as early as 1815. Barges took the flour down the Ohio and Mississippi to New Orleans before the time when the canals and railroads began to stimulate industrial development in the upper Mississippi region. But after 1856 Cincinnati was shipping wheat north and east, and New Orleans was declining in its function as a shipping port for flour. The navigation of the rivers was uncertain and hazardous, as we may learn from

PILOTING ON THE MISSISSIPPI RIVER

Mark Twain's account of piloting on the Mississippi, and the warmth and moisture of the Gulf and lower-river climate were dangerous to the grain and flour. When, therefore, the Lakes, canals, and railroads could be utilized for transportation, the direction of the shipments at once changed. St. Louis continued to manufacture and ship flour, however, and before Minneapolis came to the front as a milling center, was the leading flour manufacturing point in the country.

The rise of Minneapolis. The opening of the Erie Canal, in 1825, meant a powerful stimulus to the development of the northwestern

part of the country, and wheat and flour were among the chief articles of freight. By 1845 Ohio stood next to New York as a wheat producer and soon thereafter rose to the top; in 1860 the four leading wheat-producing states were Illinois, Indiana, Wisconsin, and Ohio, all northwest of the Ohio River. Chicago had, we have seen, started to manufacture flour before the middle of the century, and Milwaukee became prominent soon after the

STOREROOM IN A FLOUR MILL, MINNEAPOLIS

Civil War. But it was Minneapolis, favored by position in relation to the wheat belt and advantaged by reason of its abundance of water power in the shape of the Falls of St. Anthony, that was destined to become the chief milling center of the land. The industry started at Minneapolis with a small government plant, in 1823, but it was twenty years later that the first custom grist-mill was built; and the first shipment of flour, 100 barrels to Boston, was made in 1859. In 1865 there were running six mills whose daily capacity was 800 barrels, and three years later thirteen, with a capacity of 220,000 barrels. Then came into action the big mills which have made Minneapolis famous.

Improvements in milling. Pillsbury, a milling expert, speaks of these improvements as follows:

> Down to 1870 the milling process in the United States was that invented by Oliver Evans with some minor and gradual improvements. From 1787 the nether and upper millstones, the former stationary and the latter balanced to rotate upon it, ground the flour of America. The stones were set close together to produce as much flour as possible at one grinding. This produced friction and heat and brought about chemical changes which injured the color, taste, and quality of the flour. In the early milling history of Minneapolis, when enterprising manufacturers rushed the speed of stones to secure a large product, the flour came out dark, and so hot the hand could not be held in it.

Under these conditions of milling the hard spring wheat, especially, made a dark-colored flour which could command only a low price.

The passing of the millstone. Experiments were made to obviate these difficulties and resulted, about 1870, in the introduction of chilled-iron and porcelain rollers in place of the stones. Pillsbury goes on to say:

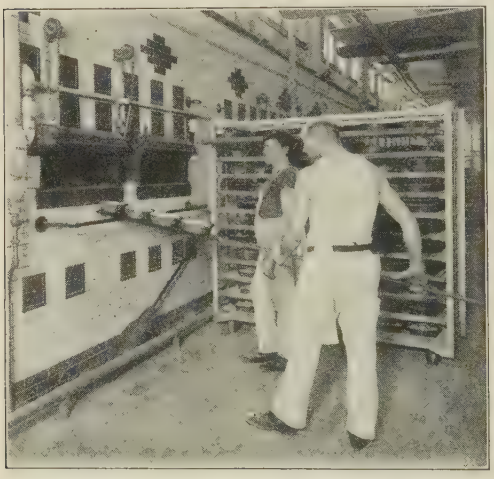
> The grain, in place of being ground in a single pair of millstones, was run through six or seven sets of rollers, being sifted and graded after each breaking by the rollers. The old process aimed to get as much flour as possible at one grinding; the new seeks to get as little flour as possible at the first two or three breakings. The old millstones were set so close together that the weight of the upper stone rested almost wholly upon the grain. The first rollers in the new process are set so far apart that the kernel is simply split for the liberation of the germ and crease. The old process sought to avoid middlings as far as possible, because they entailed loss of flour. The new process seeks to produce as much middlings as possible, because out of the middlings comes the high-grade patent flour.

This new process, in such striking contrast with the old, lent itself to the rapid development of the milling industry.

The export of flour. For the first half of the last century flour was one of our leading exports, but during the third quarter of the century the export trade fell off, largely because of the rapid progress in the technic of milling in Europe. There they were developing new processes while we clung to the old; and so

they imported our wheat and ground it themselves. But with our adoption of improved processes, after 1870, the export trade in flour took on a new lease of life.

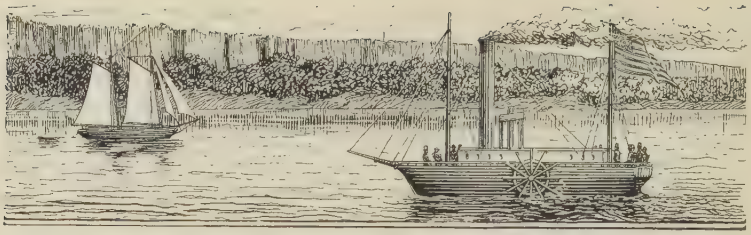
Present condition of milling. Mills are in operation at the present day in every state of the Union. Minnesota is the leader in value of product, followed by Kansas and New York. The principal grain ground or milled by us is wheat, and corn takes second place. Our flour- and grist-mills have constituted one of the most valuable industries of the land; for a time it led all other manufacturing industries in value of annual product, but shortly before the close of the nineteenth century the leadership was taken by the slaughtering and meat-packing establishments. These mills, it may be added in conclusion, produce great quantities of breakfast foods, such as rolled oats and similar articles.



A MODERN BAKERY

Other food industries. There are, of course, many other branches of the food (and kindred products) industry dependent upon vegetable materials. Let one scan the catalogue of some great mail-order house and see for himself. We shall mention several of the most important and illustrative: the manufacture of bread and bakery products; the manufacture of confectionery and ice cream; the canning and preserving of fruits and vegetables. Of sugar-refining we have made some mention in the foregoing, and the industries connected with the roasting and grinding of coffee and spice are by no means insignificant.

Conservation of food. The consumption of food in this country has always been lavish, and generally wasteful. Where corn was cheap enough to burn — where they had corn to burn, so to speak — nobody was going to make a great effort to save. Too much food was eaten for the health of the eaters; and then, again, much was half eaten and thrown away. Tons of coal have been rejected along with the ashes, and tons of food along with the garbage, not only by families that were comfortably off but even by those of the poor. Tastes have become finical and much stress has been laid upon the form in which food was presented for sale; this has led to an immense industry in making up food into novel or even weird form and to the prevalent habit of buying cereals and other foods in packages or jars, all of which have to be paid for in the form of higher prices. The development of the art of advertising in connection with food products is both remarkable and even romantic, though it may not be edifying or speak well for the common sense of the buying public. But the Great War precipitated a food shortage, and we were obliged to give some thought to conservation; a food controller clothed with wide powers was appointed. It may be one of the wholesome results of the calamity that befell the civilized world that we shall learn to value more highly our food supplies at something more nearly approximating their worth, and treat them accordingly.



CHAPTER XIX

METALLIC PRODUCTS

Importance of the metals. The transformation of metals into metallic products is one of the greatest of human achievements. In the most primitive times it was regarded as at least a semi-magical process, and the smith was both respected and feared, as being a magician. There was that about the processes of fusing and alloying that caught the imagination, and all sorts of poetical terms and expressions, such as the "marriage" of the metallic elements, grew up around the medieval alchemy (which was an eager search for some chemical element — the so-called "philosopher's stone" — which would transform baser metals into gold). There is no doubt at all that despite the error due to ignorance and all the poetical nonsense connected with the development of metallic processes, the enthusiasm of people about the metals and their manipulation was prophetic of the immense importance which metallic products were destined to take in the development of civilization. "No single thing," asserts one writer, "better measures the industrial standard of a nation than its use of metals." But a high civilization always has to rest upon a strong industrial structure if it is to persist, and so we might even say that a people's use of metals is a pretty good index of its civilization.

Earlier localization of iron manufacture. Strictly speaking, the smelting of metals is a preparatory process to manufacture. We have had not a little to say about the simpler methods of iron-smelting as developed in this country, and have only a few facts

to add in this place. It is clear enough that in the early periods of our history local smelting of iron was almost universal, but that there came about an elimination which left this process to those sections of the country which had especial advantages, such as proximity of mineral fuel and mineral. Pennsylvania was singled out for eminence in this industry, and Pittsburgh was its center of activity, for this city had also ready access to the developing Middle West.

A MODERN IRON AND STEEL PLANT

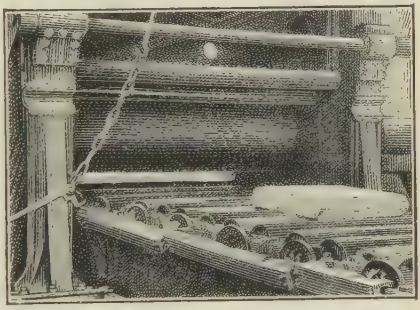
Improved processes. And then came improvement of processes. The Cort processes for puddling and rolling were the first which made iron plentiful, and for the first three quarters of the last century it was from these that the world derived its supply of the metal in tough form suitable to resist heavy strains. But these processes called for a considerable plant, complex machinery, and strenuous exertion on the part of skilled and powerful laborers — factors which were available in England, with the result that

that country held the supremacy of the iron trade during the period. A second revolution in the industry occurred between 1860 and 1870 with the invention, by an Englishman named Sir Henry Bessemer, of the Bessemer process of steel-making. By this process much time was saved. The ore was converted without any break in the process and without any cooling, once heat had been applied, directly into the final steel product. This demanded still larger plants and more elaborate machinery, and by it the production of tough iron (also called "mild steel") became possible on a vastly greater scale. Bessemer steel has displaced puddled iron in most of its uses, and the increasing cheapness and abundance of supply has not only met existing needs but also opened up new regions of demand. The first application of the Bessemer method was to the production of rails, but new and wider uses were all the time found for the cheap steel. It supplanted wood as never before, and from the greatest ships down to the smallest nails every iron instrument became cheaper and better.

Bringing coal and iron together. The Bessemer process required a special kind of ore and pig iron. Most of the Eastern ores were, for various reasons, unsuitable for the process, while the Lake Superior iron deposits could furnish an abundance of properly constituted ore. It was necessary only that the Western ore and the coal of Pennsylvania should be brought together, in order to make huge quantities of iron and steel; and the development of Lake transportation, as we have seen, solved that necessity. Then, within the last few decades, resulted that unparalleled growth of our iron and steel industry which has set us in this respect in the lead among the nations, our annual output of iron and steel being nearly half of the world's output.

Foundries and rolling-mills. But the manufacture of iron and steel is but begun when the first processes formative of the raw product are done. The foundries and rolling-mills are next in order. Roughly speaking, the foundries make castings by pouring the liquefied metal into molds of various sorts. There were

foundries in operation in this country before 1750; these early plants did a good deal of custom work and made numerous articles, such as cooking utensils, for domestic use. At the opening of the nineteenth century they could take care of the home demand for hollow ware. In the course of time there has been great specialization in this branch, so that instead of making a variety of articles, a foundry will devote its efforts to the manufacture of a single specialty, such as stove-plates, plow-iron, or heavy castings for engines. Then there is the rolling-mill for the hot rolling of iron and steel into bars and rods, plates and sheets (many of them for subsequent tinning, to form tin-plate), rails, bands, hooks, or structural shapes. Up to 1860 most of the rolled product used in this country was imported, but thereafter American rolling-plants were set up. The product of the rolling-mills has steadily and swiftly increased, until at the present day their output constitutes a large percentage of the total iron and steel industry.



SLAB ENTERING ROLLS TO BE ROLLED INTO PLATE OF STEEL

Elaborated iron products. The products of the further working up of iron and steel are so multiform that it is out of the question to survey them otherwise than in a sort of special encyclopedia, but we shall illustrate this further stage of manufacture by several selected cases.

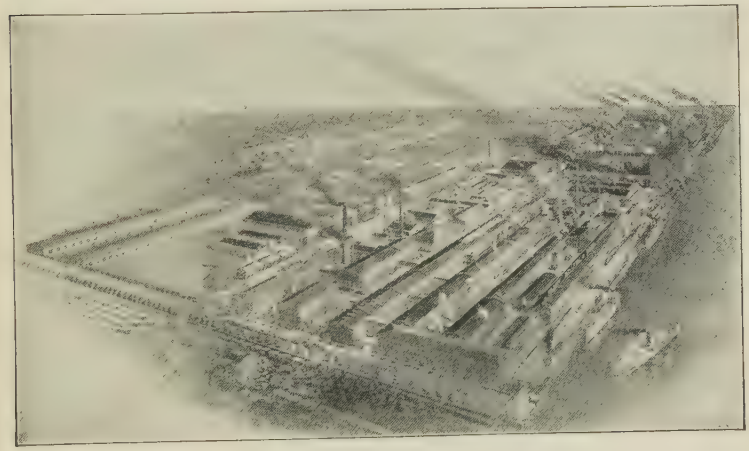
Stoves and furnaces. One of the important developments of the foundry industry is the manufacture of stoves. The growth of the market for stoves, especially coal stoves, went along with better facilities for distribution and with the increase of population; and the demand rose with the housing of population in buildings put up after the economy and convenience of stove

heating, and at length furnace heating, became recognized. Evidently the large modern hotels and apartment houses could never have been rendered habitable in the winter on the old plan of fireplaces or by the first simple stoves. By the middle of the last century our annual output of stoves and ranges was worth upwards of $6,000,000. The industry centered in those cities which had the advantage of cheap transportation to the largest body of consumers; this was the factor that favored the migration of stove manufacture to the West. The centers of this business have been New York, Providence, Philadelphia, Albany, Buffalo, Pittsburgh, Cincinnati, and St. Louis. Stoves are, of course, only one product of the foundry; cast-iron railings and fences, fountains and animals, and especially wheels, are scattered examples of foundry work. Wheel-casting, like stove-making, has come to be a specialized industry.

Tools and hardware. Tools and other hardware represent an important branch of the same industry. Until the beginning of the nineteenth century, or later, the local blacksmith or cutler made the American mechanic's tools, and there was no great uniformity about them in the matter of size, shape, and general character. Among the first tools made in this country for general use was the ax; by the close of the eighteenth century most axes used in this country were of domestic manufacture, and one of the most noted ax factories in the world was established, in 1828, at Collinsville, Connecticut. Handsaws and mill saws are said to have been manufactured in Philadelphia in 1790; and about the middle of the last century the Disston saw factory was one of the largest in the world. Other tools for the carpenter were manufactured here previous to the War of 1812, but the tool industry did not get firmly on its feet till about 1830; by that time there were cutlery and tool works at Worcester, Paterson, Philadelphia, Pittsburgh, and Chambersburg, the last of these towns making chiefly carpenters' tools. Knives of all sorts and table cutlery were manufactured at Worcester, Northampton, Philadelphia, Pittsburgh, and Auburn. Soon after 1830

such industries reached Cincinnati, but in 1860 New England still produced about half the edge tools and three quarters of the cutlery made in this country.

Prominence of New England. There is no object in trying to trace in detail the history of hardware manufacture; it is, in fact, so varied in character that it is impracticable to render a brief account of it. The localization of this form of metal manufacture in New England and its expansion and successive stages of



A GREAT FACTORY FOR MAKING SAWS

organization show the same determining factors which we have already seen in connection with other such enterprises. Here, too, it was the Yankee inventions which helped to hold in these vicinities the manufacture of clocks, house hardware, and the many mechanical devices connected with what might be called "Yankee notions."

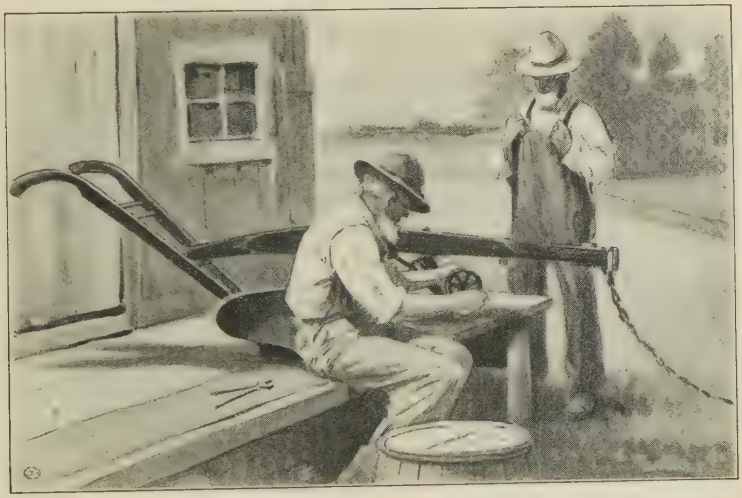
Ironworking machinery. Tools were thus, at first, largely made by hand; but a significant development emerged presently, stimulated probably by the high cost of labor here, in the form of ironworking machinery. American ingenuity has devised all sorts of machines for fashioning iron and steel, thus dispensing

with handwork; this is, indeed, so characteristic of America that we are usually too impatient, as well as too ill-trained for the purpose, to undertake industries where the labor has to be prevailingly handwork. The result is that our factories are filled with much and efficient machinery run by a relatively small number of operatives; a very large proportion of the operations which require the expenditure of tremendous effort or of slight effort are now executed by machinery, and are performed better and faster than they could be by human labor. This general application of machinery to the working of metal has resulted in the establishment of important factories for the manufacture of iron and steel tools and machinery. There are borers, drills, turning-lathes, planes, hammers, dies, shears, rolls, punches, screw and bolt cutters, riveting and welding machines, cranes, milling machines, polishers, and numberless other devices, with many forms of each. There seems to be no limit to the number of machines which can be invented for working iron, some noted for their labor-saving services and others for their apparently superhuman accuracy.

MACHINE FOR TIGHTENING BARREL STAVES AND POUNDING HOOPS IN PLACE

Standardization of parts. A most significant development of the American machine and machine-tools industry is the standardization of parts. This is carried to a high degree of success

wherever a large product is put forth by the use of machine methods, as in the watch industry, where a timepiece can be put together by selecting one each from piles of wheels, mainsprings, and other parts. This idea of interchangeable parts seems to be a matter hardly worth mentioning, because so obvious — it is taken for granted; but there was a time, not so many decades ago, when it was very difficult to have a broken or outworn part



ADJUSTING A NEW INTERCHANGEABLE PART ON AN OLD MACHINE

of a machine or tool replaced without having it specially made. The first foreign observers of this American method were astonished beyond measure; but now, having been popularized in world's fairs and otherwise, it has been adopted, as possessing self-evident advantages, throughout the civilized world.

Engines. We might go on indefinitely with metallic products, confining ourselves to iron and steel alone; but we have selected only one further example of this order — engines, chiefly for locomotion. The first steam engines for railroads which were used in the United States were imported from England; this was at the very outset of the railway era, about the beginning of the second

quarter of the last century. The practice did not last long, for a number of concerns undertook to build engines here, with the result that within a few years American locomotive shops were able to meet the demand of the railroads of the country ; then, after some experimentation in the East, shops were opened in other parts of the country. From their early and humble beginnings our locomotives have increased in size and power until nowadays they are a marvel of efficiency, commanding the home-market and being found on railroads in practically every country in the world.

AN EARLY AMERICAN LOCOMOTIVE BESIDE A MODERN GIANT LOCOMOTIVE

Early engine manufacture. There were engines built and in operation in this country before the railway locomotives. Soon after the Revolution they were used to propel ferryboats and for other purposes. Before 1810 engine shops were constructed in the vicinity of New York City and at Pittsburgh, and by 1820 engine-builders plied their trade in various parts of the country. Plants were likely to be located where there was river, lake, or ocean navigation ; marine engines were coming into demand. After 1830 there was a demand not only for this sort of engine but also for engines to be used in Eastern factories, in steam-blowing and pumping (in particular in the anthracite mines of Pennsylvania), and for many other lesser purposes. This led to

the enlargement of the engine-making plants on the seaboard and to the improvement of their equipment and methods.

Locomotive engines. But the building of locomotives, because of patents connected therewith, soon became a distinct branch of manufacturing, in which Philadelphia, with its famous Baldwin Locomotive Works, founded in 1832, took the lead. Many engines were built solely for foreign buyers; and as the railroad development went on, extensive engine shops and repair works came to be located in districts widely separated from one another.

A NINETEENTH-CENTURY DINNER SET MADE FROM SHEETS OF METAL

Jewelry and silverware. As an example of a metal industry quite different from those based upon iron and steel or copper, we have selected the jewelry and silverware production for brief description. It is known that there were several shops devoted to this industry in colonial times; and about 1800 silver plate and gold-filled jewelry were being manufactured in Providence, Rhode Island. By 1830 various towns in Massachusetts were making the same articles. Precious stones had their principal market in New York City, which therefore became an important center for jewelry. Very little silverware was used by the early colonists, for they were, for the most part, too poor. It was not until close upon the middle of the nineteenth century that the

manufacture of this ware began to develop. At this time there came into being the art of electroplating, which cheapened the cost of table silver and stimulated its output. The earlier artisans who had worked here in silver made their articles, such as dinner and tea sets, by hammering out the pieces from flat sheets of solid metal. Silver-manufacturing is an important contemporary industry in this country, and a great variety of ornamental and useful articles are on the market.

Progress of the metal industries. The following statements will give some further idea of the present-day importance of the metal manufacture of the United States and of its development in recent years. According to a recent Census of Manufactures the capital involved in the manufacture of iron and steel products alone, to say nothing of the numerous other metal manufactures, was in excess of that invested in any other large group of industries, such as the textile and food-producing groups. The wages paid in the iron-and-steel branch of the industry were about equal to those paid in any other group of industries. The value of the products of the iron-and-steel branch was surpassed only by that of motor vehicles.

CHAPTER XX

TEXTILES

What they include. The textile industries are here understood to include (1) the manufacture of various fabrics; (2) the conversion of these fabrics into articles for personal wear; and (3) the making of textile products other than those for personal wear. The second and third of these evidently depend upon the first for their materials. There are four leading materials from which the textiles manufactured in this country are made, — cotton, wool, flax, and silk, — and the textile industries based upon these materials occupy second place in value of product among the sixteen large groups of industries distinguished by the Census — exceeded by the group Food and Kindred Products. On the basis of the average number of wage-earners employed, however, the textile group takes first place.

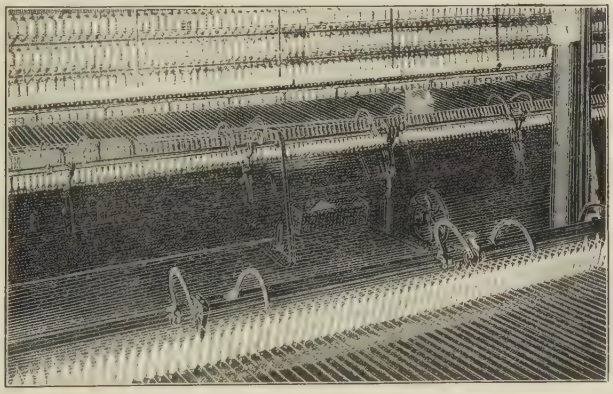
The colonial industry. Although the cotton industry takes an easy first place as compared with the other members of the textile group, historically it was later of development. Woolen and linen cloth for domestic use was "homespun" in early colonial times; it was not until the arrival of immigrants skilled in the trade that fulling mills were built. About the middle of the eighteenth century the Northern colonies were making practically all the cloth they needed and the colonies, as a whole, about three quarters of their requirement. The product was of a very coarse grade, and throughout the colonial period England and Ireland furnished the bulk of the finer qualities of linens and other textiles.

Linen. As late as 1810 flax exceeded, in this country, both cotton and wool as a textile fiber. The first factories were established shortly after the Revolution and, from flax and hemp, produced canvas, cordage, sailcloth, and other articles in domestic demand. These early manufactories were in New England and had, of course, no power-driven machinery. Bounties were offered to encourage the production of the articles just mentioned, but when they were removed the industry languished. Factories were established, as time went on, for making finer goods from flax, but the growing ascendancy of cotton checked their development; a mill persisted here and there, but the industry did not attain any important dimensions prior to the Civil War; in 1860 we were making only about $800,000 worth of linen goods. In fact, the development of the industry was slow until the opening of the twentieth century, when it had reached a product value of about $4,000,000; since then, however, this figure has nearly doubled. Formerly large quantities of our flax were used for making twine and cloth, but now the situation, despite the growth of the linen industry, has shown something of a shift; there has been a marked decrease in the production of flax for textile purposes, almost all the flax crop being now utilized for the seed, from which linseed oil is made.

THE OLD METHOD OF SPINNING FLAX

Woolens. The British government discouraged the production of woolen goods in colonial America, wishing to preserve the market for the English product; the export of woolens and even

the transfer of certain woolen goods from colony to colony were forbidden. Imported woolens were expensive, and so we find the colonists wearing leather garments like the Indians. But the British laws did not forbid household production, and the spinning and weaving of cloths and blankets went on in the home. In 1790 there were a few woolen factories in the country, but they were not prosperous. The industry was stimulated during the Embargo and the wars that culminated in the year 1815, but it was hampered



MODERN SPINNING MACHINE

at the same time by an insufficiency of domestic wool and by taxes on imported wool. It is said that factory-made woolen goods increased in value between 1810 and 1815 from $4,000,000 to $19,000,000. Then followed a period of depression, and it was not until 1830 that woolen manufacturing got its first good start.

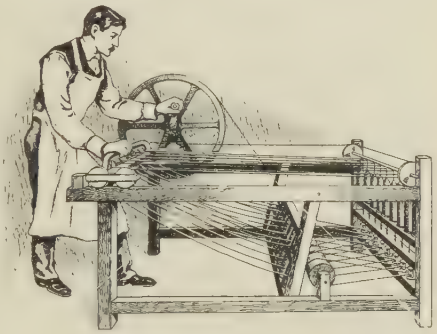
The woolen industry slower in starting. The specialized manufacture of woolens and mixed cloths was a later development in America than that of cottons. Part only of the raw materials needed was produced in this country; and the transition from household to factory spinning was made harder by an accompanying change of spinning fibers. The processes in making woolen goods are more complex than those used for cotton, demanding experienced hands in cloth-making and in dyeing and

finishing as well; and so it took longer to develop automatic machinery for wool-working than for cotton-working, and there was a smaller field for the employment of unskilled labor and for the use of power — two conditions of great importance in the competition with Europe. Also the prosperity of this industry was peculiarly affected by the various changes in tariff legislation.

Progress of the industry. The start attained in 1830 carried the industry along, and it was enabled to make use of the power loom in manufacturing hosiery, carpets, and other products. This development occurred chiefly in the Middle States, where the wool was grown; half of the woolen mills of 1850 were in Pennsylvania, New York, and Ohio. The early woolen manufacture, as in the case of cotton, was strongly intrenched in New England, but lack of domestic raw wool held it back. In 1860 there were nearly 1500 woolen-manufacturing plants in the country, employing about 50,000 operatives and turning out an annual value of nearly $75,000,000. Then, between 1860 and 1880, appeared a remarkable growth of the business, due in good part to the falling off of cotton production, during the Civil War time and later, and to the extraordinary demand for woolens for the armies. The various branches of woolen manufacture have continued to expand, during the last few decades, along such lines as woolens, worsteds, felt goods, carpets, and rugs, until at the present day there are about $990,000,000 in capital invested and an annual value of product in excess of a billion dollars. An interesting feature of our woolen manufacture is the large number of small mills scattered all over the country — a relic of colonial conditions; but the bulk of the factories is where the population is, Massachusetts holding first place for woolens and worsteds and third place for carpets. New York leads in carpet manufacture, in which detail, both as to quantity and variety, we surpass all other nations.

Cotton goods. Cotton manufacture is the typical fiber-working industry. We are already introduced to it in part, from what has been said earlier about cotton. In the chapter on cotton we have

taken up something about the elementary processes of spinning and weaving. We have seen that the invention of the gin was the turning point in the industry, for the product was so cheapened as to bring it within the reach of the people as a staple for clothing manufacture; it also led the industry out of the home and into the factory. The period between 1810 and 1830 was the time when this movement was making itself most strongly felt. But the construction of textile-manufacturing machines and their introduction into American factories was a process fraught with difficulty; England, wishing to secure and keep the monopoly of the industry for herself, prohibited the exportation of machines and also plans and models of machines. American manufacturers had to smuggle in what machinery and machine drawings they could get.

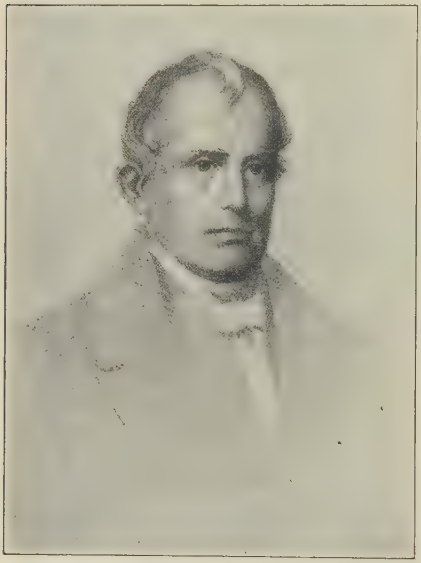


THE FIRST SPINNING JENNY

American cotton machinery. But, as a matter of fact, it was not so long after the English machines were in operation that they were duplicated in this country; it is said that the first cotton factory in this country was built in Beverly, Massachusetts, in 1787; and then factories were established in New York, Pennsylvania, and Rhode Island. The credit for building the first complete cotton machinery and operating it in a factory goes to Samuel Slater, sometimes called the Father of American Manufactures, who set up his business in Pawtucket, Rhode Island, in 1799. But development was slow; in 1804 only four cotton factories were to be found in the country.

Eminence of New England. Then New England began to take hold, investing in the new industry the capital previously employed in shipping, but later rendered idle by the Embargo.

In 1808 there were in New England 8000 cotton spindles in operation, three years later 80,000, and by the close of the War of 1812 half a million; and the figures for consumption of cotton by domestic manufacturers confirm this fact of rapid expansion. Up to 1814 machines did the spinning, while the weaving was done on hand looms and in the home; but in that year the various processes of spinning and weaving were brought for the first time under one roof. This was at Waltham, Massachusetts, in Lowell's factory, which has been called the first complete factory in the world. Nearly all of the early textile mills being very poorly constructed and meagerly equipped, they consequently turned out only the coarser grades of products. But the factory system spread rapidly, and the factory towns grew up on the streams of New England and the Middle States. Such towns were Lowell, Lawrence, Holyoke, and Fall River, in Massachusetts.



SAMUEL SLATER

The industry preceding the Civil War. The general depression following the close of the war period that ended in 1815 was felt in the cotton industry; only the best located, managed, and equipped mills survived after 1820. By 1824, however, the cotton industry was on a sound basis, and from that time on has shown steady growth; by 1830 the United States was surpassed only by England in the amount of raw cotton consumed annually. At that date over $40,000,000 were invested in cotton manufacturing, over

77,000,000 pounds of raw cotton were used annually, and the value of the manufactured product was about $26,000,000. The industry, as we have seen, came early to be located in New England, which possessed a number of the advantages named above (p. 201) as favorable to industrial development. As early as 1840 New England mills were turning out about three quarters of our cotton goods. By the time of the Civil War nearly $100,000,000

CARDING, DRAWING, ROVING, AND SPINNING, AS INTRODUCED BY SAMUEL SLATER

were invested in the business, over 422,000,000 pounds of raw cotton were consumed annually, 120,000 people were employed in the mills, and the value of the manufactured product exceeded $115,000,000. Over 85 per cent of the cotton goods consumed in this country were being made here, only the finer qualities being imported; and besides controlling the domestic market, we had an important export business.

The industry after the war. The Civil War, which resulted in the cutting off of supplies of raw cotton, rendered two thirds of the spindles in the country idle; but there was a rapid recovery

afterwards. Between 1860 and 1880 the amount of raw cotton consumed, and the number of spindles in operation as well, doubled. Great improvements were made in processes of manufacture, steam was more and more replacing water power in factory operation, and conditions were coming into being which were to allow cotton factories to locate in the South.

Development in the South. This development in the South represents a striking change in the cotton industry. North and

COTTON MILL IN THE SOUTH

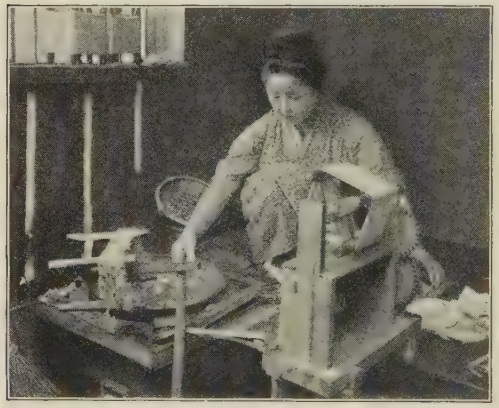
South Carolina and Georgia especially showed marked progress; the value of the cotton products of these three states constituted 6.2 per cent of the total in 1880, as against 29.7 per cent in 1910. During the same period the capital invested in Southern cotton mills increased from about $22,000,000 to $360,000,000; the number of spindles rose from about 600,000 to nearly 4,400,000; and the consumption of raw cotton from about 200,000 bales, of 500 pounds each, to 2,500,000. This desirable result was due to the usual combination of advantages: proximity to raw materials, excellent water power, and a supply of cheap labor; and it was attained largely at the expense of New England mills and, still more, of those of Europe.

Advantages of New England. New England, however, has not by any means been driven from the field: Fall River and New Bedford, Massachusetts, are the leading cotton-manufacturing cities of the country, New Bedford being probably the producer of the best cotton cloth made in New England. The labor situation in the New England textile industries is typical of American industry in general. Although the New Englanders, after a century's experience as textile workers, are skilled operatives, the industry no longer depends upon native stock. Within recent decades large numbers of French Canadians have come from Quebec to the mill towns of New England. Here they find employment which is lacking in their own country, with its large and rapidly increasing population. In recent years larger numbers of Europeans also have come, with the result that the mill towns show many languages. Thus has New England also been provided with a relatively cheap class of labor, comparable in some respects with that of the South.

GATHERING MULBERRY LEAVES FOR SILKWORMS

Present conditions. At present there are about 1500 cotton manufactories in the country; the capital invested is about $1,915,000,000; the annual value of the product is over $2,000,000,000. In this matter of value of product Massachusetts is easily the leader, followed by North Carolina, South Carolina, Georgia, and Rhode Island, the order varying somewhat in different years.

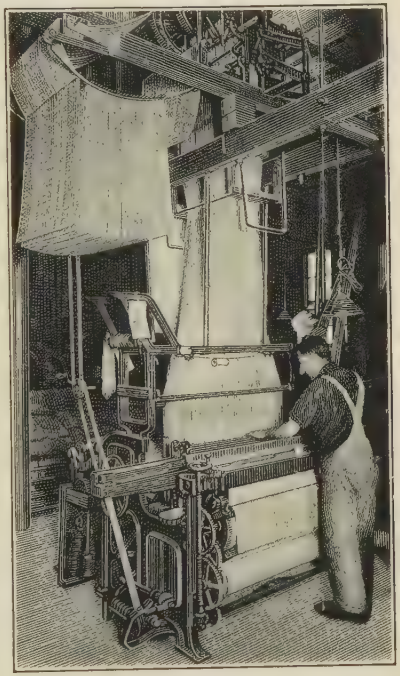
Silk. Silk manufacture was the latest of its group to extend outside the household. Silk was raised in the eighteenth century in Georgia, South Carolina, Pennsylvania, and Connecticut, and as early as 1790 bolting cloths were made at Wilmington, Delaware, and small goods at Philadelphia, from American materials. Connecticut manufactured several hundred pounds of sewing silk annually, in households, and sold it at home and in neighboring states. But there was no manufacturing enterprise of any importance in this earlier period.



UNWINDING THE SILK FROM A COCOON

Development of the silk industry. Sixty years were necessary to teach Americans that they could not raise silk with profit; in fact, the highest expectations along this line were seen in the late thirties, during which period household manufacture of silk persisted, and mills used domestic materials. In 1810 reeling and twisting were done by water power in certain Connecticut villages; and between that time and 1840 plants designed to use American silk were started at a number of scattered places, both within and without New England. Some of these undertakings were successful and worked out valuable improvements in the machinery used; but most of them failed, either because they lacked raw materials or because they lost in silk-raising more than they earned in silk manufacture. Some of the states, but not the national government, gave legislative encouragement to this industry. The unwinding of the cocoons and the conversion of their material into a continuous and even thread requires skill and patience,

together with labor that is both skillful and cheap. But these factors could not be found in America, for this sort of labor could not be procured here; and so certain preliminary but essential processes never came to be performed economically and perfectly on a scale to support mill industries.



A SILK LOOM WEAVING DESIGNS IN SILK

The industry after 1840. Americans could manufacture silks well enough, even though they could not raise the raw material; that is, they could do that which did not demand patience so much as originality in devising machines and labor-saving devices generally. They were making ribbons and trimmings in 1810; and the whole situation was solved about 1840, when China began to send us raw silk in quantities. During this period the mills ceased to depend upon local material. Between 1840 and 1860 there was a marked advance in the industry, notably in making sewing silks; a number of small factories were built up, prominent among which was one at South Manchester, Connecticut, now a model manufacturing town containing one of the largest silk plants in America. Yet by the middle of the last century the silk industry was still an infant: in 1860 the product of all our silk mills was worth about $6,500,000 annually, of which value sewing silk contributed more than half. The invention of the sewing machine in the middle of the century gave a stimulus to the demand for sewing silk, and

machine twist was being produced in 1852; but it was not until after the Civil War that ribbons and dress goods were manufactured in any quantities.

Recent development. The Civil War was succeeded, as we have seen, by remarkable growth in the cotton and woolen manufacture; but a development still more wonderful took place in the case of silk. The value of silk products increased from the $6,500,000 of 1860 to $41,000,000 in 1880 and has continued to rise rapidly ever since. There are now over fifteen hundred plants, as compared with three hundred and eighty in 1880; these employ over 125,000 operatives, and the annual value of their output is about $760,000,000. Pennsylvania is the most distinctively silk-manufacturing state, though Paterson, New Jersey, is still referred to as "the Lyons of America."

Artificial silk. An important development of the twentieth century has been the commercial manufacture on a large scale of artificial silk from wood pulp or cotton linters. The product (rayon) is made through a chemical process. The industry is growing rapidly. The yarn made from artificial silk is made up into hosiery, shirts, and various other articles.

Other fibers. The manufacture of fibers other than the ones we have mentioned is relatively unimportant. One illustration may be given. The manufacture of hemp was a rather important industry in colonial times and for a quarter of a century thereafter; hemp was used for making cordage and bagging — in fact, the manufacture of these products and of sailcloth, articles much needed in commerce and fishing, was one of the earliest industries of the nation. The manufacture of hemp migrated westward; about 1850 Missouri became a rival of Kentucky, and of the 9,540,000 yards of bagging reported by the Census of 1860 the latter state made about 5,750,000 and Missouri about 2,000,000 less. Hemp production has decreased along with that of flax.

CHAPTER XXI

LUMBER AND PAPER

Importance of wood. The really indispensable articles to man's life on earth are few and simple, but one of them is wood. The savage has often gotten along without metal, but he has had to have wood for fuel and shelter. The only notable exception is the Eskimo of the Far North, and it is only by the exercise of the utmost ingenuity that he gets on with the few pieces of driftwood that fall to him. He has become an expert in the use of bone in making tools and weapons and of snow for winter shelter. The little wood that comes to him is very highly prized; in fact, small and weak pieces of driftwood are skillfully pieced and glued together to make a block big enough to do anything with. This was in the time, of course, before the white man came to him; and the whole story but illustrates to what limits men may be driven in the absence of this basic natural resource. Hardly any other part of the natural environment enters more intimately and vitally into the life economy, and certainly into the beginnings of the industrial career, of the human race; consequently a country with extensive forest areas is at an advantage in the struggle for existence and in the competition with other countries.

Our forest resources. We have already described the forest resources of our country and have seen that originally, in both extent and value, they were unsurpassed by those of any other civilized country; that we have carelessly spent these resources, so that approximately one half of the value of our forests has

been used up; and that a conservation movement is now on foot whose aim is to have the annual growth at least equal the annual drain.

Early processes. The European colonists who began our national history were forced to start the business of lumbering at once; they had to build themselves shelter and they were obliged to clear land for cultivation. The houses were made of logs, and whatever boards or shingles were needed had to be

LOG CABIN OF AN EARLY SETTLER

hewn out or split by hand. The invention of the sawmill was an important incident in colonial history. It was invented in this country in 1633. Sawmills were located on eligible streams, and settlements were not infrequently determined by the presence of a stream affording water power. Mills were in existence in various places in New England by the middle of the seventeenth century, and spread to other parts of the country as these were settled; the sawmill followed the pioneer wherever he went, after as well as before the Revolutionary period. The simple mills of the day cost anywhere from fifty to five hundred dollars, usually formed a combination with grist-milling, — so that the log-owner

paid the miller for the sawing, — and produced a rather petty product. The census of 1840 reports over 30,000 lumber mills, with a total product value of nearly $13,000,000, or more than $400 per mill. For the first four decades of the nineteenth century the exports of timber rarely exceeded $5,000,000 a year.

Lumbering. This timber business, however, was of importance to the population. For shipbuilding large timber was needed, and there were often cut single pieces that brought two hundred dollars or more. Lumber was carted to town like farm produce. One Saturday in 1816 there arrived in Belfast between three and four hundred sleighs loaded with lumber, and in 1822, in a single day, 136,000 feet were brought there by team. Lumber was in reality a sort of by-product of land development.

ICING A SLED ROAD IN A LUMBER CAMP

Localization of the industry. The application of the steam engine to the sawmill changed the character of this industry. Where formerly the mills hugged the streams at some local or general fall line, they now could follow the timber; and where formerly the logs were floated downstream to their destination (which was another reason why lumbering stuck to the rivers), now the industry came to be closely associated with railroads and railroad-building. A sort of intermediate stage, in some places, was where the timber was transported by canal. The modern development of lumbering has been connected with railroad extension more closely, probably, than that of any other industry. Not seldom has the lumberman been a pioneer in railroad building, and not a few roads of to-day were laid down rather recently as part of a local lumbering enterprise. Large-scale production followed upon the extension of railroad transportation, and this was concentrated in the soft-wood areas, where a highly developed variety of

sawmill, differing materially from the earlier type, accompanied a much more intensive organization of the industry. White-pine lumbering in the states around the Great Lakes produced a number of big organizations with large capitalization, and Southern and Western lumbering largely imitated the methods, which had already gained much prestige, of the great Northern pine region.

A STEAM SAWMILL

Shifting of the industry. Three causes have combined, since the middle of the nineteenth century, to bring about a shift of the scene of large-scale lumber production in the United States: first, railroad development; second, concentration of manufacture; and third, destruction of forest areas by fire. These factors have brought to pass a rapid exhaustion of the forests and a consequent necessity for the industry to seek new fields. In 1850 the northeastern states furnished 54.5 per cent of our lumber, the Lake states 6.4 per cent, the Southern states 13.8 per cent, and

the Pacific states 3.9 per cent. In 1880 these percentages were 24.8, 33.4, 11.9, and 3.5 respectively. Recently they were 9.0, 10.5, 47.7, and 19.3 respectively. The figures for intervening decades show that this movement was a constant and consistent one. And this shift has meant change in the nature of the output: white pine, which used to constitute about half of the total product, is now something like a tenth, and the leading woods now cut are yellow pine, Douglas fir, white pine, hemlock, oak, spruce, and Western pine.

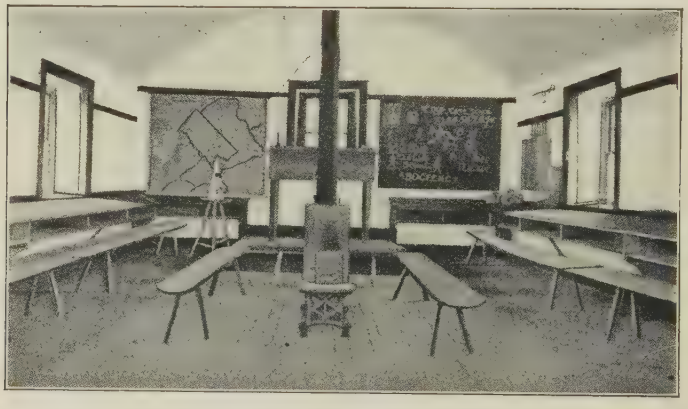
Importance of the industry. Lumbering is now, as it always has been, one of the basic industries of the country. There are over five hundred thousand wage-earners employed in the production of lumber and in its remanufacture, and as an agency of employment of labor this industry is surpassed only by farming and a few other callings. In value of product lumbering and connected enterprises stand high among the industries of the country, being surpassed by only a few.

The planing mill. We turn now to illustration of the industries consequent upon and allied with lumbering. The planing mill produces a large number of commodities, such as sashes, blinds, doors, interior woodwork, moldings, and a great number of minor products connected with building and other operations. Here are products worked up from the raw timber and approximately ready for use, needing only the fitting in at the hands of the local artisan.

The furniture industry. Then there is the furniture industry, which has grown to large proportions. This industry deserves particular mention. It was built up in this country from very humble beginnings. At first much of the furniture, and practically all of the finer variety, was imported from England — cabinets, chairs, tables, chests, and beds. These were highly valued, as one can see from reading the wills of colonial times: a man will be found to have carefully enumerated such possessions, leaving his bed to this person, his favorite chair to another, and so on. Furniture was imported because the colonists lacked fine tools and technical knowledge; and then, again, they were all more or

less pressed by the necessity of producing food and other articles of an indispensable order. Fine furniture was a luxury on the frontier, and whatever was homemade was of the rudest description, as, for example, the schoolroom benches without backs, the discomforts of which have been set forth in novels and stories of colonial and frontier days.

Its earlier development. The local furniture business started, of course, in the local carpenter shop. Here were fashioned plain



AN EARLY EIGHTEENTH-CENTURY SCHOOLHOUSE

hardwood chairs, benches, and bedsteads "strong as a house." Everything was massive and there was no pretense of style; native wood was used, for the mahogany and other more elegant furniture was imported. It was not until after the beginning of the nineteenth century that furniture-making began to be separated from general carpentry work; and it was stimulated during the War of 1812 by an import tax. In 1815 there were a good many furniture-makers at work in the large centers of population, and American ideas began to appear. The rocking-chair was an American product and also the art of veneering. Furniture soon came to be lighter, handsomer, and cheaper. The demand increased; for while in the earlier period the home was but scantily furnished, now families bought a dozen pieces where they had

formerly bought one. By the middle of the century the domestic furniture manufacture had complete control of the domestic market, and the only importation was of the most fashionable and costly varieties, in total value not comparing with that of the American product. The use of machinery, the better transportation, the specialization of the cabinet shop which confined itself to furniture, the new devices which were always being invented—these factors caused the industry to assume large proportions, so that in 1850 the value of furniture produced was about $15,000,000 and the employees numbered 37,000.

FURNITURE OF THE COLONIAL PERIOD

Progress since the Civil War. The industry suffered much by reason of the Civil War, but it revived promptly and has had an almost unbroken prosperity since. The bulk of the manufacturers engaged in making a product appropriate for the homes of the masses at a price within reach of all. Improvements in woodworking machinery have made it progressively advantageous to replace handwork by imitating it to a high degree of nicety. New models and new articles have been evolved: it is said that the bureau, the folding bed, and most of the combination pieces which can be used to economize space in small city apartments are of American origin. Many changes have been made in the varieties of wood used: early in the nineteenth century mahogany, maple, and black walnut were the mode; then cherry and ash became common; about 1880 oak came into prominence; and at present mahogany, curly birch, and maple are used in the better grades

of furniture. There have been notable changes also in the style of upholstering, the haircloth, favored years ago, having been supplanted by a variety of more pleasing textures and colors.

Present conditions. At the present day the United States is the most important manufacturer of furniture in the world, and, in addition to the control of the domestic market, we also are the greatest exporters of this product, which we send to all parts of the civilized world. The present value of our annual furniture production is about seven times that of the 1899 product. The greatest increase in business has taken place in states of large population — New York, Pennsylvania, Illinois, Ohio, Michigan, and Wisconsin. The superior character of the wood in certain parts of these last two states is largely responsible for their standing in the industry. Grand Rapids, Michigan, for example, is a very important center for furniture manufacture, although its population is small. The cities which figure most prominently in the manufacture of furniture are Chicago, New York, Grand Rapids, Philadelphia, and St. Louis. The states whose products have the greatest value are New York, Illinois, Michigan, Pennsylvania, Indiana, and North Carolina.

Paper

Early stages of paper-making. Paper-making is an ancient art; the Egyptians made paper from the papyrus plant (whence the name), though it was not much like what we now call paper. The Moors in Spain, however, eight or nine hundred years ago, manufactured a product more like ours; paper mills are said to have been in operation there as early as 1085. The invention of paper-making in the modern sense thus came before the invention of printing, but until the press was at work the consumption of paper was small. Books were too rare and expensive to cause any demand for paper competent to summon an industry into being. The development of the newspaper was what created the big demand. It is recorded that the first news sheets were

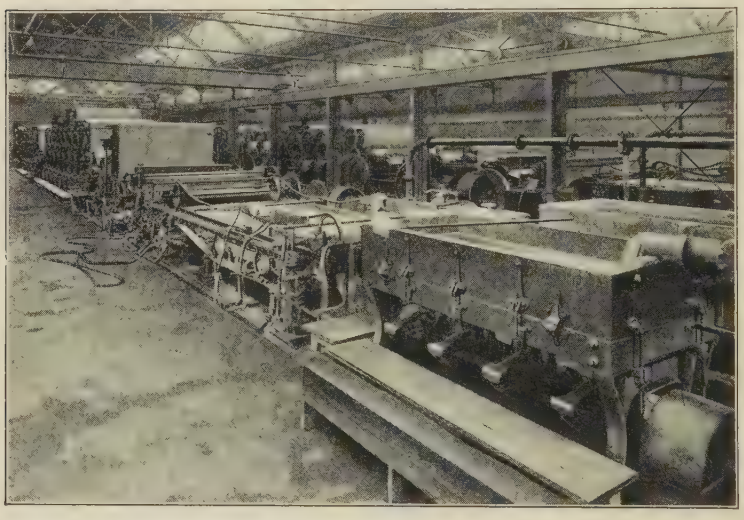
printed in England in 1622, and soon thereafter arose a considerable demand for these and for pamphlets and books. Paper mills then attained some prominence in Europe, and their output was relatively large.

Use of linen rags. The first paper material was vegetable fiber, and a wide variety was tried. Then, in the fourteenth century, linen rags came to be employed; at this time the clothing worn in countries like France, Spain, Portugal, and Italy, even among the peasantry, was largely linen, and much cast-off clothing was available for rags. In the seventeenth century these countries and Holland gained considerable reputation for papers made from linen; but when cotton came into common use, cotton rags supplanted linen rags, just as cotton cloth had superseded linen cloth.

THE EGYPTIAN PAPYRUS PLANT

Paper manufacture in the colonies. When the colonists came to America they soon became great users of paper. Oiled paper was used, in the absence or costliness of glass, for the windows. Printing was soon developed here, and newspapers and pamphlets appeared in relative profusion; many sermons were printed. In short, paper was consumed in comparatively large quantities and figured prominently among the imports. The English government forbade paper manufacture in the colonies, but mills were started, none the less, there being one near Philadelphia as early as 1693. At the opening of the eighteenth century there were paper factories in Massachusetts, Pennsylvania, and New Jersey; and shortly

before the Revolution there were forty factories in Pennsylvania, New Jersey, and Delaware. These factories used cotton or linen rags. After the Revolutionary War broke out paper importations were cut off, which stimulated paper-making here: the paper for the Continental notes was made in Pennsylvania, and in 1791 Hamilton lists paper manufacture as one of the most important



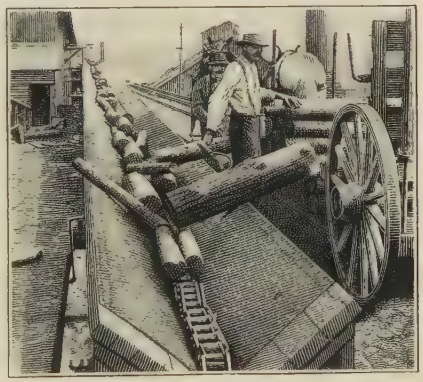
THE INTERIOR OF A MODERN PAPER MILL

industries of the country. The qualities made were of great variety — for writing, printing, wrapping, sheathing, for the covering of walls, and so on.

The use of machinery. The earlier papers were handmade, for paper-making machinery was rare. Then, early in the last century, came the Fourdrinier machine, by which the fluid stock is manufactured into finished paper by an automatic process. As long as the product was handmade the output was bound to be slight, but the introduction of large machines made possible an immense increase in product. Paper-making machines were brought to the United States about 1820, but we soon began to

make our own. These machines were a great boon to Americans: labor here was high and hand manufacture costly, and the American genius, as we have already shown, lies in processes which do not require so much time and patience. The greatest development and perfecting of paper-making machinery has come since the Civil War.

The use of wood pulp. Along with the great improvements made in paper manufacture has gone great change in the material from which the stock is made. Many articles are still used for paper-making, but the cheapness of wood pulp, with such an abundance of wood, altered the whole business during the latter part of the last century. Many varieties of wood have been tried, but perhaps the most available is spruce. The pulp-wood is cut into lengths suitable for grinding and the bark removed; then the blocks are held firmly against a revolving grindstone and gradually reduced to a mushy consistency, or pulp. This pulp-wood is the basis for all lower grades of paper. The wood is often treated nowadays by a chemical process instead of being ground; this is an American invention first used in 1867.



A CONVEYOR BY WHICH LOGS ARE CARRIED IN A PAPER MILL

Recent developments. Paper-making has become an important American industry only since about 1870, for until then very little wood pulp was used, and the wholesale character of manufacture could not appear. To-day this pulp is the main source of the world's paper supply, and it has changed the location of our paper mills. They used to be found in the large centers of population, along the small streams, and on the borders of or even within

cities and towns; but since 1890 the industry has migrated to the forest areas, especially those of New York and New England, where the desirable spruce is to be had. A great deal of power is required in paper-making, and this is supplied mainly by water. Because the northern New England states and New York had both the spruce and the water power, they have become the greatest paper-manufacturing districts in the United States. Massachusetts too has the water power and is near enough to get pulp from the Northern forests; it has also a skilled labor supply and is near both to the centers of population and to those ports through which enters the supply of rags. It should not be thought that paper-making from rags has passed utterly away; it is still an important branch of the industry and produces the finest and costliest paper, chiefly for writing. Holyoke, Massachusetts, is a notable paper-manufacturing center, especially for fine writing paper made from textile fragments.

Rapidity of recent development. The rapidity of growth of the paper and wood-pulp industry can be seen from the following figures. In 1869 the value of output of our mills was $39,000,000; $57,000,000 in 1879; $79,000,000 in 1889; $127,000,000 in 1899; $267,000,000 in 1909; at the present day, over $907,000,000. The states which figure most prominently in the industry are New York, Massachusetts, Maine, and Wisconsin, but a number of others have an important output of wood pulp and paper. The United States ranks first among the countries of the world as a producer of this commodity.

Wall paper. We wish to select one variety of paper, namely, wall paper, by way of illustration of the special development of the industry. This is an article whose use is traceable to the Old World, but it was of little interest to the colonists; only in homes of wealth was wall paper to be found before 1750. Whitewashed walls were regarded as the proper thing, and this fashion persisted down to the Revolution. In fact, "wall hangings" is a better name for what later became wall paper; for even the wealthy, who imported such articles, merely hung them up against the

walls, so that they could be moved about and from house to house. Shortly before the Revolution some few wall hangings were manufactured here, and though the paper was very poor, its use revolutionized house decoration in this country. Until near the middle of the last century American makers of wall papers did not undertake to cater very much to the demands of wealth and taste, but engaged, rather, in supplying the masses with cheap hangings. It was shortly before the middle of the century that the first important advance was made in the development of the industry for printing wall papers; machines were imported in 1844. Previously the printing had been done by hand and the value of the annual output was small; there were only five factories, employing some five hundred men and producing a product whose annual value was only $250,000. But by 1860 there were twenty-six establishments, making about $2,000,000 worth of paper hangings a year; and now there are about fifty factories whose annual output is valued at $34,000,000.

Styles in wall paper. We may conclude with a quotation from Bolles, written in 1878, which sheds some little light upon the fashion in house decoration.

> Not only are the styles of paper constantly changing, but the tastes of people also change concerning their use. Only a few years ago it was generally believed that many kinds of wall paper were unhealthy, because of the poisonous ingredients put in the coloring materials; while the paste used in sticking papers to the wall attracted moisture, making rooms damper than they would otherwise be. Accordingly, a period of general wall-scraping was inaugurated. Having thoroughly cleaned off old paper and paste, walls were painted; it being everywhere admitted that the colors adopted were healthy, as well as more pleasing to the eye. But now taste is setting once more in the opposite direction, colored walls are being recovered with paper, the most stylish mode of putting it on being to use three shades, — the lightest shade for the middle or body of the wall, a darker shade for the top and a still darker for the bottom. By and by we shall doubtless hear of another change, made as suddenly as this; and perhaps wall papers may be discarded altogether.

Here speaks more wisely than he knows a kindly satirist of fashion, for thus it swings from one extreme to the other.

Other uses of paper. Some of the uses of paper could scarcely have been anticipated years ago. We hear of paper car wheels, and the latest years have seen the development of a prosperous business in making paper roofings. Such roofings are of tarred paper strewn with powdered stone; they are readily and speedily put on in long and wide overlapping strips, will shed rain perfectly, and last for many years. It is easy to imagine what might have been the astonishment of the Egyptian who first made papyrus paper on the banks of the Nile had he realized some of the uses to which the offspring of his invention were to be put.

CHAPTER XXII

LEATHER AND RUBBER

Skins as clothing. Leather is the tanned hide of animals, chiefly nowadays of cattle and horses and, less commonly, of sheep, goats, and other smaller beasts. The untanned skins of wild and domesticated animals constituted the first clothing that deserved the name; man took the coat off the animal and put it on himself. Thus leather long antedated textiles for body protection. But it was necessary to treat the hides in order to render them pliable enough for use, and gradually processes corresponding to what we call tanning were developed. The Indian women used to scrape the bison hides until they were thin and then make them still more pliable by rubbing in the brain or fat of the animal. They certainly had attained the art of treating skins and pelts; of the quality of their deerskin garments nothing but good can be said. But the skins were cured by smoking, for they did not understand the use of oak or hemlock bark in genuine tanning.

The leather industry in the colonies. The American colonists carried on the tanning process at an early date, and almost every village had its tannery; Roxbury, Massachusetts, was a tanning center as early as 1647. In some of the colonies laws were passed at an early date regulating the disposal of hides and tanning in general, as, for example, in Massachusetts in 1642. Butchers, curriers, and shoemakers were prohibited from tanning, for the idea was to make this a separate occupation; only a tanner was allowed to buy a hide. Also it was against the law to sell

poorly tanned leather; curriers were instructed as to how their part of the work was to be done, and shoemakers could use only leather which was marked and guaranteed by the inspectors to be a first-class product. In 1646 this colony forbade the exportation of raw hides or of leather that had not been worked up; and other colonies passed similar regulations. The attention devoted to the business shows its importance in the eyes of the settlers.

Tanning. Tanning is a process calculated to fill the pores of leather and make it lasting. It consists mainly in so treating the skins that they are freed from flesh and fat and then soaking

SEASONING LEATHER BY RUBBING IT WITH OIL

them in a liquid containing some tanning preparation. In early times the process was a long one and lasted from a year to fifteen months, but it was effective and the leather was almost indestructible; when skins were finally certified as being tanned, they were really tanned, not merely doctored up with chemicals. Until the middle of the nineteenth century the tanning material was hemlock or oak bark. Then, as the forests were cut away and more and more hides appeared for treatment, new tannin products were forthcoming from different parts of the world. But as long as the vegetable tannin was in common use the location of hemlock and oak forests largely determined the location of the industry. Then, about 1850, came the discovery that tanning could be done without the use of vegetable materials; that is, by the use of chromium compounds. The development of this process of tanning occurred in Philadelphia, which soon became the leading leather-manufacturing city of the world.

Varieties of leather. The hides of all sorts of animals are now made into leather. Fur-bearing pelts are tanned without disturbing the hair. Thus are produced a great variety of leathers: the heavy hide is made into sole leather and into material for belting and harness; calfskin finds its principal use in the uppers of boots and shoes and in bookbinding; sheepskin is employed for shoe-linings, whips, aprons, and gloves; goatskins are adapted to the manufacture of gloves and ladies' shoes; pigskin is used for

COLORING AND FINISHING LEATHER

making traveling bags and saddle parts; dogskin is in great demand for gloves, and horsehide for the toughest and roughest hand wear. Porpoise hide will make good and durable leather. Though it is now used almost solely for shoestrings, the time will doubtless come when this resource will be better utilized. In addition to this list of leathers, the kangaroo, alligator, elephant, rhinoceros, walrus, and shark furnish their peculiar varieties. Leather is becoming so scarce and high-priced nowadays that leather substitutes are getting into the market; in Germany, where the Great War occasioned various clever economies, it is said that a shoe with only the uppers of leather and the sole made of thin and pliant wood is found to be practicable.

Boots and shoes. When we consider the uses of leather, the first thing we think of is boots and shoes; and there can be no

better example of the practical utility of this product. In the eighteenth century the saddler and shoemaker followed close upon the tanner, and by 1731 Americans were almost fully supplied with shoes of their own manufacture. Shoemakers were located in towns and also went from house to house working up the family leather supply; so, too, cobblers went about from house to house. Massachusetts even manufactured a surplus of shoes, which were sold in other colonies and in the West Indies. An impetus was given the shoe industry when, in 1764, the colonists showed their resentment of England's placing of duties on American imports by refusing to buy British goods. During the Revolution there was great suffering from scarcity of shoes and leather, but the industry revived after 1783.

BEFORE THE INVENTION OF SHOE MACHINERY

Importation of hides. Since we had not enough hides, these were imported from South America and the East; the cattle industry of this country has, as we have seen, made extraordinary progress, but we have not been able to supply ourselves with leather and have kept on importing hides until to-day they constitute one of the principal items among our imports. We have raised our cattle chiefly for meat, not hides; and the two purposes are not so easily combined, for the best leather comes from tough, rangy steers whose beef is inferior. The preparation and manufacture of leather from both our own domestic product and from these importations have been developed by the United States until we lead the world in

this line. And although there are many distinct varieties — not to mention qualities — of leather goods, the most important branch of this business is the one we have started out to survey, namely, the boot and shoe manufacture.

Prominence of Massachusetts. Massachusetts is still leading the country in this industry; her leadership dates very far back and has already been referred to as an illustration of the advantage of an early start. As early as 1635 a skillful shoemaker settled in Lynn, and fifteen years later the town was making more shoes than were made in any other town in the colony or even in the country — especially women's shoes, which were largely of cloth. But most of the shoemakers of this period were quite unskilled, and even in the early part of the eighteenth century well-made shoes were derived almost solely from England. Lynn, however, was the chief source of supply for New England, and marketed shoes in New York, Philadelphia, and even farther south. In 1750 another superior shoemaker, a Welshman, settled in this town and, because of his skill, soon became locally known as "the celebrated shoemaker of Essex" (the county in which Lynn is situated). From him a number of local people acquired a better knowledge of the art, and the business of the town increased. In 1764 it was reported in the *London Chronicle* that the women's shoes made at Lynn exceeded in beauty and strength any that were usually imported from London. The towns of eastern Massachusetts provided the Revolutionary army with most of its shoes, and in 1788 Lynn alone exported 100,000 pairs, a figure which rose to 300,000 in 1795. Lynn had such a reputation for the rapid manufacture of shoes that a legend developed to the effect that the materials, having been stuck to the wall with an awl, were combined in the proper manner by a blow of the lapstone skillfully aimed at them. It was asserted that boots and shoes grew spontaneously at Lynn. In any case, for over two centuries this town has had an ascendancy in the American shoe manufacture, and all this was due, we are told, to the fact that the Welshman settled there rather than elsewhere.

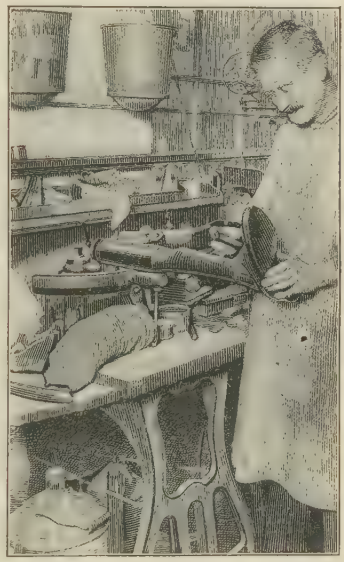
Improvements in manufacture. Great improvements have been made in the shape, style, and durability of American shoes since 1750. This is due partly to imitation and partly to Yankee ingenuity, also in some degree to the improved quality of the leather for uppers, resulting from superior splitting and currying processes. Methods of manufacture have been much improved. In the old days shoes were sewed by hand, and the American invention of the shoe peg did not come till 1818. This invention had a powerful influence upon the industry ; the pegs were first made by hand, then by machinery, and had a big market among

MAKING CUSTOM SHOES

shoemakers all over the country when it was discovered how much cheaper pegging was than sewing. In fact, numerous establishments soon appeared which made nothing but pegs; it is reported that the tradition was current in New England that at one time shoe pegs became so plentiful and cheap that artful speculators tried to sell them to farmers as a new variety of seed oats.

The use of machines. The invention of the sewing machine was opportune for this industry, for it was adapted to the purpose and diminished hand labor very greatly, also taking the manufacture out of the domestic field into the factory, where large numbers of the new machines could be operated by power. Machines were built for pegging shoes and for smoothing the rough soles after the pegging ; lasts too were made by machinery, and so hand labor

was further diminished or done away with altogether. Since the middle of the last century it has been the labor-saving machinery that has made our boot and shoe industry what it has become ; the shoe factory is a product of the latter half of the century, and the hand processes have been disappearing. In constructing a shoe there is at the present day a perfect system of continuous manufacture involving nearly a hundred operations, and machinery is being continually improved, the keenness of competition forcing factories to adopt new devices at once. After the general adoption of machinery came a noteworthy concentration of manufacturing in Massachusetts ; Brockton, Lynn, and Haverhill together have produced about a fifth of all the shoes made in the country and half of all made in the state. Other important centers are St. Louis, Boston, New York, Manchester (New Hampshire), Cincinnati, Rochester, and Philadelphia.



TREEING THE SHOES — ON FORM, OR TREE

The industry in the West. The establishment of boot and shoe factories in parts of the country other than eastern Massachusetts was not undertaken until well along in the last century, and it was due to the enterprise of certain individuals who set out to avoid the heavy expense of shipping a commodity like shoes from the East to the great markets in other parts of the land. There are now numerous well-equipped and prosperous factories throughout the West and elsewhere. The industry is scattering geographically.

Rapid strides. The development of the industry during the last few decades has been remarkably rapid ; since 1879 the number of establishments has decreased, but there has been a marked

advance in the number of operatives, capital investment, cost of materials used, and value of product. Our shoe manufacture caters, however, mainly to the domestic market; the foreign trade in shoes is small. This is due in part to the export of American shoe-machinery, so that foreigners are in actuality making American shoes.

Saddles and harness. The manufactures of saddlery and harnesses, of trunks and valises, of gloves and mittens, are important branches of the leather industry. With respect to the first, it may be recalled that saddles were in much greater demand than harnesses in the early history of this country; good roads were few, and the mails and messengers used the saddle horse. Later there was an increasing demand for harness. The earlier forms were for heavy stages and wagons, and the lack of saddlery and harness hardware was a severe handicap to the early development of the industry. Such hardware had to be imported from England and transportation was exasperatingly slow. Horse collars were made as early as 1828, and harnesses came in with road improvement. The industry has continued to develop until, at the present time, saddlery and harnesses stand for an annual value of over $40,000,000.

DELIVERING MAIL IN OUR EARLY HISTORY

Gloves. Glove and mitten manufacture in this country dates from about 1760, when some Scotch glove-makers settled in New York State and provided hand-coverings for farmers and woodchoppers. It was not until early in the last century that

gloves were manufactured for more than local consumption. It is reported that a storekeeper of Johnstown, New York, had a lot of gloves made in 1809 and took them on horseback to Albany, where he found an easy market. He then secured the services in glove-cutting of the daughters of neighboring farmers, and the gloves were made up by the farmers' wives. This seems to have been the beginning of the commercial glove-making business in this country. These so-called gloves were really mittens, not gloves; about 1825 a resident of Gloversville, New York, took a load of real gloves to Boston and disposed of them satisfactorily. Thus the impetus of an early start came to Gloversville and Johnstown, and they now manufacture together nearly half of the leather gloves and mittens made in the United States.

THE LAST PROCESS IN THE MANUFACTURE OF GLOVES

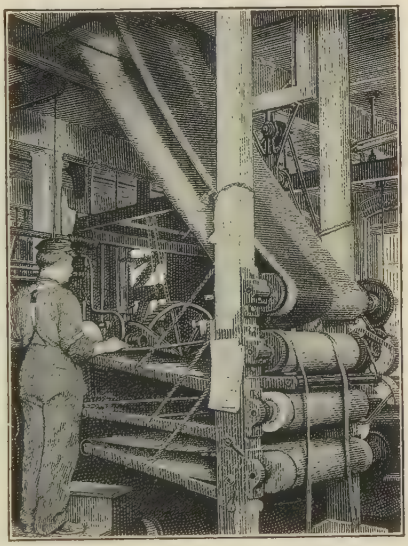
Present conditions in the leather trade. The present prices of leather and leather goods are such as to cause concern: the domestic-animal industry has not kept pace with the growth of population in most countries, and the situation is reflected in the rise of meat and leather; and the demand caused by the Great War forced prices still higher. There seems to be no likelihood of a speedy return to former conditions, and it is to be hoped that American ingenuity will speedily devise some relief for the poor and even the moderately well-to-do.

Rubber

A tropical product. Rubber is a vegetable product and by no means a modern one. Columbus found the Indians using it, and Spanish soldiers smeared their cloaks with the gum to waterproof them. French investigators, who came to America in the earlier part of the eighteenth century in search of scientific information, told of the strange forest trees whose sap, when properly treated, furnished a substance as flexible as leather and as impervious to water as metal. The natives called the gum *cahuchu*, from which comes the word "caoutchouc"; but the English called it "India rubber." An account of the manner in which it is gathered does not belong to a history of American industries, but is described in a book entitled "Commercial and Industrial Geography," by the authors of the present book. It is enough to say that it is all imported in raw form from tropical countries; here we have to do only with its manufacture.

Earlier uses of rubber. The commodity was unknown to science until 1735, and as late as 1770 it was used almost solely to make "rubbers" for erasing pencil marks. The first rubber ever brought to this country is said to have been imported into Boston in 1800, the year of the birth of Charles Goodyear. But for fifty years prior to 1823 there was much experimentation with the substance and many records of dismal failures, for the rubber industry, in other countries as well as in this, was of little significance until the discovery of the process of vulcanization. However, in 1823 Mackintosh made a fairly useful application of it by starting a factory in Glasgow for the waterproofing of cloth; his products were good for a while, but could not stand the heat. Over here the attempt was made to imitate the Mackintosh process, but with little success; the stuff got too hard in cold weather, too soft in warm, and dissolved if it touched oil or grease or even the moisture of perspiration. The substance could not be mastered, and finally people grew impatient with it. Several factories failed, and it looked as if India rubber could be used only for imperfect waterproofing and for erasers.

The Goodyear invention. This was the situation when Goodyear came along with his great discovery, in 1842, of vulcanization. "After ten years of patient study and experimenting he accidentally spilled a combination of rubber and sulphur on a hot stove, and quickly discovered that the heat made the rubber dry like leather and that thereafter it was neither melted by the heat nor cracked by the cold. Many other processes have been developed around the Goodyear process, which consists in mixing rubber and sulphur at a moderate heat and then raising it to a temperature ranging from about 250 to 300 degrees Fahrenheit."[1] Goodyear thus introduced to the public an elastic, nonadhesive, vulcanized India rubber which was as different from the pure gum rubber as gold is from brass. Here was the beginning of the modern industry, and the next step was the invention of hard rubber, or vulcanite.



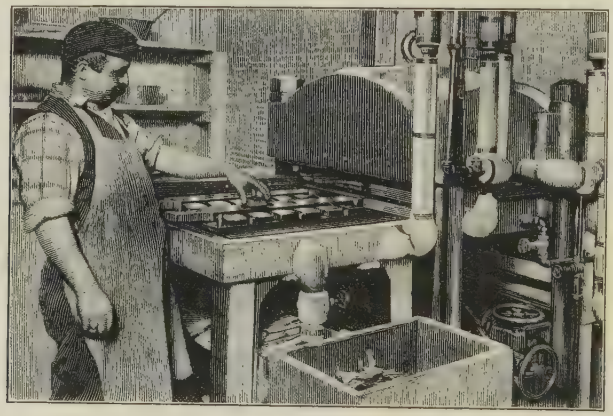
CYLINDERS FOR ROLLING OUT SHEETS OF RUBBER FOR SOLES

Rapid growth of the industry. These discoveries revolutionized the rubber manufacture in the United States. Companies were formed under the Goodyear patents, and by 1850 over $3,000,000 worth of rubber goods were being manufactured in this country. Ten years later the few large factories were making over $5,500,000 worth, and by 1870 sixty-five plants were manufacturing annually rubber goods to the value of over $14,000,000. These factories were concentrated in New York, New Jersey,

[1] Keller and Bishop, Commercial and Industrial Geography, p. 93.

Connecticut, and Massachusetts. At present there are about five hundred establishments, turning out annually a product valued at $900,000,000. To such a stature has an industry grown that had been virtually given up in disgust!

The demand for rubber. The Civil War lent a powerful impetus to the rubber industry, especially in its relation to clothing, for the government gave out large contracts for rubber blankets, and rubber boots and shoes were in great demand.

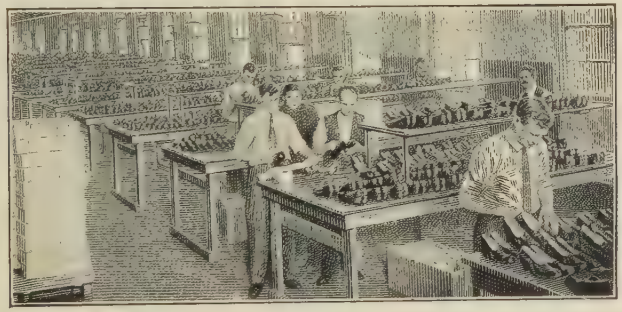


HYDRAULIC PRESS FOR MAKING RUBBER HEELS

Soon after the war the manufacture of mechanical goods was greatly stimulated, and the general industrial development called for ever-increasing quantities of rubber; railways needed packing, and hose was in demand for carrying water, steam, and gas. Expansion of the factory system called for rubber belting; the first rubber belt was made in 1836, but it was not until after the Civil War that belting of this sort became popular. The invention of the pneumatic tire, shortly before the beginning of this century, together with the marked expansion of the bicycle and automobile industries, raised the demand for rubber higher than ever before. All these factors and also the development of the great electrical industries of the country combine to explain

the tremendous expansion of the rubber industry within the last two or three decades. Hard rubber, or vulcanite, was patented about the middle of the last century, and combs were the first articles to be made extensively out of it; since that time all sorts of products, such as pipe fittings, buttons, inkwells, penholders, and rulers, have been fashioned out of vulcanite.

Rubber footwear. The leading branch of rubber manufacturing in this country, however, from the very beginning down to the day of the automobile, was the making of rubber boots and shoes.



PACKING RUBBERS FOR MARKET

The essentials of this process are described in another book by the present authors.[1] This industry was of comparatively small importance until 1880, but between 1890 and to-day the number of factories rose from eleven to twenty-five. Massachusetts leads in rubber footwear, as in other kinds. It is to be noted that recent years have shown a small increase of establishments, but a large increase of product; this means heightened efficiency of the old factories.

Automobile tires. The main branch of our rubber-goods industry at the present day is the manufacture of automobile tires. The quantity of rubber consumed in this line alone is tremendous; and in the manufacture of our rubber products — tires, footwear, mechanical goods, clothing, druggists' supplies, and hard rubber —

[1] Keller and Bishop, Commercial and Industrial Geography, pp. 94–99.

we consume a large percentage of the world's output of cured rubber. The natural rubber trees are no longer depended upon for the supply; plantation rubber has largely replaced wild rubber in the world's trade. Chemists have made synthetic rubber, but it has not yet come into serious competition with the vegetable variety. Ohio far surpasses any other state in the production of rubber tires and inner tubes, on the basis of value of product.

Use of old rubber. Another interesting phase of the rubber industry is the reclaiming of old waste rubber. There are collected annually vast quantities of old rubber in the form of discarded rubbers, rubber boots, shoes, belting, hose, and other articles made either in whole or in part of rubber. This waste is reduced to powder and treated in various ways, after which it is ready to be sent to the mills for manufacture into rubber goods.

CHAPTER XXIII

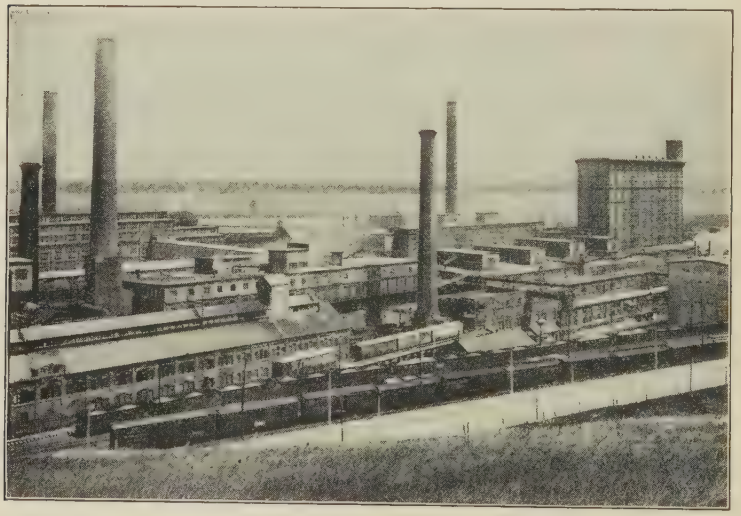
CHEMICALS AND DYESTUFFS

The practical value of chemistry. Chemistry has come to occupy an exceedingly practical place in modern industry. As a matter of fact, from the time he learned to make fire, man has always practiced the chemical arts; the metallic processes are chemical at bottom, and so are those of agriculture. But these were carried on, in their earliest stages at least, without any understanding of their nature and certainly without any scientific insight or equipment.

Elaboration of products. It remains true, however, that products which require a good deal of working on them seldom, if ever, reach the stage for final consumption without having been subjected to some chemical process. This is a matter of common knowledge, although it is sometimes overlooked. Every metal must be refined; fibers must be bleached, purified, and dyed; leather, rubber, soap, and various kinds of food products must be preserved; the materials of buildings, ships, and cars must be protected from the weather; articles such as salt and sugar must be purified; sand and clay must be treated before they can be converted into various manufactured objects. But none of these things can be accomplished by mechanical means alone; chemistry is called on to participate in all such processes. The very earliest conquests of man over nature lay in the development of chemical processes of a simple order — in fact, it might be said that the fundamental invention of all, that is, fire-making, was

a chemical one. It has been said that to deprive industry of chemistry would be like removing gravitation from the universe. The result would be chaos.

Sulphuric acid. The manufacture of chemicals in this country started in 1793, when sulphuric acid, the most important manufactured substance used in the chemical industry, was made in Philadelphia by John Harrison. Harrison made lead paint also,



WHERE SOME SODIUM PRODUCTS ARE MADE

and while his enterprise was very small in its beginnings, it proved profitable, and soon his plant was expanded until it reached a capacity of nearly half a million pounds of sulphuric acid annually. It is said of this acid that it is a chemical barometer, and even that one can gauge the civilization of a people by the amount of sulphuric acid they use. In 1825 and later other concerns followed Harrison's beginning; it is said that the Chemical National Bank in New York was established with funds derived largely from the manufacture of sulphuric acid. Various other acids are produced in the chemical industry: nitric acid was manufactured

in Philadelphia as early as 1834, as was muriatic acid also; then there are "mixed acids" formed of nitric and sulphuric, which are used in nitrating organic substances such as glycerin and cellulose. Acetic, lactic, citric, and tartaric acids all have their importance in the industrial world, as well as in medicine.

Slow expansion of the industry. For many decades after our beginnings the chemical industry expanded slowly, for, as we have several times remarked, Americans seem to be cut out for mechanical invention of a practical and immediate utility rather than for that which requires more time and patience, as, for instance, laboratory experiment and study. Until the middle of the last century the most necessary chemical materials were manufactured in different Eastern cities on a small scale; lead and zinc paints, various dyes, saleratus, and the acids were made, but the industry was relatively insignificant. The great development has been a matter of the last few decades; much is being done now, and there is even greater promise, for our relations with Germany, the country which has led the world in chemical industries, became such that we were forced to turn our attention toward independence of her products, especially in the matter of chemicals and dyestuffs.

Sodium products. We have spoken of the acids. Another important chemical, with extensive uses, is sodium bicarbonate, which is used in making soap, glass, and other products. The process of manufacture goes by the name of Solvay. Common salt furnishes the sodium needed, so that the plants are often located in the neighborhood of salt deposits. Sodium bicarbonate occurs also in certain lakes in the eastern part of the country, the water of which, strongly charged with soda, can be evaporated to get the desired product.

Fertilizers. The production of artificial fertilizer is, perhaps, following the preparation of sulphuric acid, the next most important branch of the chemical industries. Among the essential plant foods are phosphorus, potassium, and nitrogen; these are the three most vital foods, because they often exist in the soil

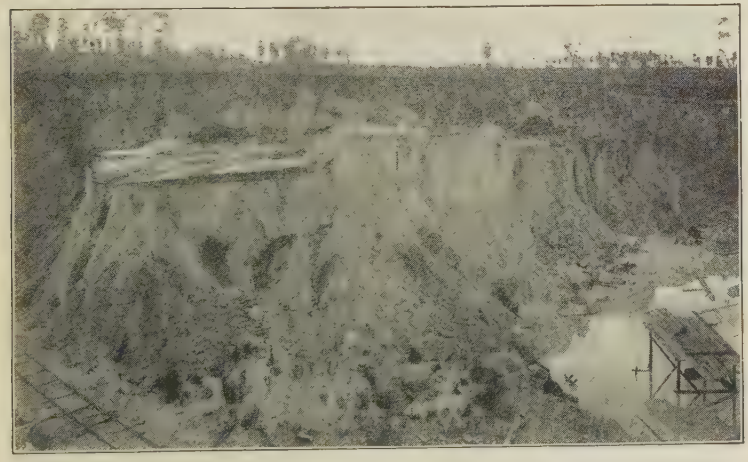
in quantities too small for the needs of crops, so that the soil has to be strengthened by artificial means. Phosphorus is that plant food whose future supply involves the greatest concern. It is found in large quantities in various forms, such as in bones of animals, both recent and fossil. Phosphate rock is composed largely of such fossil remains of animal life, containing the phosphorus originally concentrated in the living bone; such

LABORATORY FOR THE MAKING OF SODIUM PRODUCTS

deposits are mined and treated chemically to produce fertilizer. By treating phosphate rock with sulphuric acid, what is called superphosphate is formed. The manufacture of artificial fertilizers in this country is recent, dating from about 1850, when some experiments were made in Baltimore, but the industry has continued to develop rapidly. There are large deposits of phosphate rock in Tennessee, Florida, and South Carolina, with probably much larger quantities of low-grade rock. In 1911 rock phosphate was discovered, in extensive deposits, in three different places in Montana. And we have found several other sources

of phosphorus; for instance, the basic process of iron and steel purification yields a by-product called Thomas slag, or basic slag, which is used quite extensively in England and Germany.

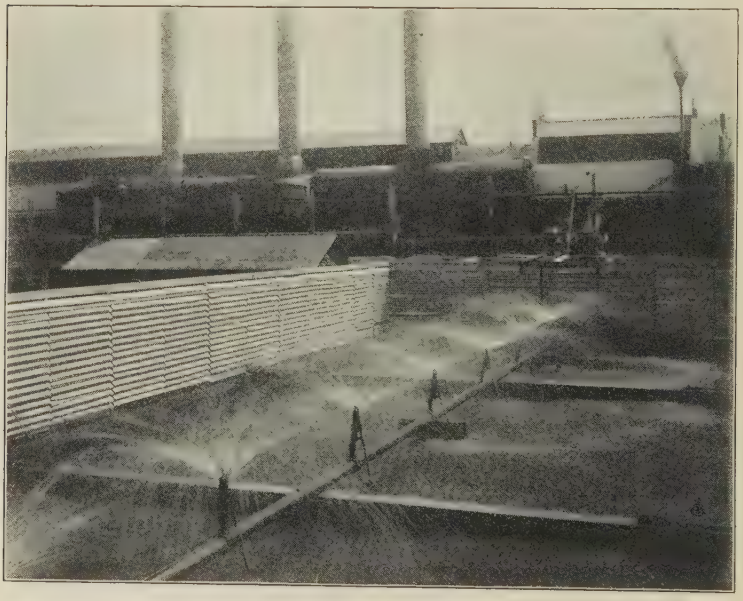
The use of fertilizers. Before going on with the other fertilizing elements, it is in place to recall what has been said before about the great natural resources which we once had in the soil. There were, not so long ago, regions in the Middle West which produced large yields without an ounce of fertilizer. It was only



VALUABLE PHOSPHATE DEPOSITS IN FLORIDA

with the threatened exhaustion of the soil that we had to consider fertilizers at all, and this accounts for their late development here. The earliest form of fertilizing was the natural one of burning off the overgrowth and leaving the ashes; later on the manure of cattle was used, and so were fish of the coarser and less palatable varieties. This habit of using fertilizer is one which people have to be forced to acquire; and for many ages a people would abandon its lands and move on rather than go to the trouble of artificially restoring the soil. But when this art had been forced upon them, because they could not move on or for some other reason, they then began to study the characteristics of plants and

of soils and to develop a science where formerly there had been at most a sort of chance success. In this country, with all the exuberance of soil and other favoring resources, we were naturally tardy in paying attention to these matters; we went ahead and used up what there was, and only when the pinch began to come did we set our minds to the conservation of our resources.



EVAPORATING MUDDY WATER CONTAINING POTASH DEPOSITS

Potash. Next to phosphorus the element of great significance among fertilizing agencies is potassium (potash). The great reserves of potassium deposits were long supposed to be confined to Germany; her deposits were thought extensive enough to meet the world's demands for many generations. But the Great War caused the rest of the world to set about the discovery of other deposits or other sources of supply. Extensive potash deposits have been found in the western part of our country, and they can be utilized commercially; it had long been

known that we had deposits in a number of localities, but their commercial importance was supposed to be slight. The manufacture of potash salts in the United States started in 1915, when a product worth over a third of a million dollars was shown. It seems that potassium is produced in some cases as a by-product from the manufacture of Portland cement in California. Potassium sulphate was made in Utah and Nebraska and placed on the

A WESTERN PLANT FOR THE MANUFACTURE OF POTASH PRODUCTS

market in 1915, and some of this desirable article was obtained from kelp cut on the Pacific coast. Thus it seems that a brand-new industry has been born among us; in view of the importance, even the indispensability, of potassium, the commercial production of potash salts is a matter of considerable interest to the country.

Nitrogen. Until a few decades ago there was much concern among agricultural scientists as to the future supply of the plant food nitrogen. There are unlimited quantities of this element in the atmosphere, but plants cannot feed upon this free nitrogen; it must first be converted into a nitrate. There are a good many

sources from which nitrogen can be derived for the manufacture of fertilizer, but until recently the supply that could be produced was comparatively small. Waste parts of animals, dried fish, etc. were the source of nitrogen fertilizer; so-called fish factories existed along bodies of water such as Long Island Sound, and suffered more or less from legal proceedings instituted by shore-dwellers who objected to their odor. Then there are extensive deposits of sodium nitrate in Chile and farther north along the west coast of South America; and there were formerly locations where guano was so thickly deposited as to be susceptible of mining. But nitrates are now manufactured freely as a result of the discovery that nitrogen by electrical methods can be combined with other substances so as to form nitrates. The advance of chemical and physical science has thus solved the nitrogen problem so far as agriculture is concerned.

The future of fertilizers. The increasing demand over the world for foodstuffs and the depletion of the fertility of the soil in most parts of the world by unscientific methods of farming are combining to call for more and more artificial fertilizer. It may be said that among future generations the demand for such means of keeping up the fertility of the soil will be as fundamental a demand as that for coal and iron; chemical industries productive of fertilizers are likely, therefore, to have an important future.

Other chemical industries. There are a number of chemical articles produced by the aid of electricity; in general, it is the consuming heat of the electric furnace which permits the melting of certain substances, for instance, calcium carbide, which in combination with water produces acetylene gas. Other branches of the chemical industry are the manufacture of oils and soaps, the latter being produced by the action on fats of some chemical like soda or potash. Coal tar is a by-product of the coal-gas industry, and under distillation yields oil, creosote, benzol, and other elements, and, especially, the coal-tar dyes, presently to be further considered. The value of our chemicals and allied products has expanded at a rapid pace within recent years.

Dyestuffs

The popularity of coloring. Dyestuffs have interested human beings since very remote times, for clothing and ornament have been colored by the use of vegetable and animal substances by most primitive races. Many tribes, to realize their ideals of beauty, have even tattooed the skin and colored the teeth and hair. One of the great motives in the development of trade in the Mediterranean by the Phœnicians was the value set upon the color purple, as seen in the Biblical expression "purple and fine linen"; for, since the color was derived from a shellfish, the Phœnicians were led out upon the sea, and then farther and

PLACING THE SKEINS IN RACKS TO DRY, AFTER DYEING

farther on, in quest of supplies of material. The human eye delights in color, and there will always be a steady demand for color-giving substances. The formerly common dyes were supposed to exist already formed in the plant or animal and so came to be known as "natural" dyestuffs; among the more important of these are logwood, fustic (the heartwood of certain tropical trees), and indigo. The last is one of the oldest of dyestuffs; in colonial times in America, when the manufacture of textiles was a household art, the indigo tub was as common a household article as the churn.

Beginnings of our dyestuffs manufacture. The actual manufacture of dyestuffs started in this country early in the last century; there are records of dyes being made at Poughkeepsie, New York, in 1816, and in Philadelphia in 1834. At the present time they are made, in a very large proportion, from coal tar and so are a by-product of the coke oven. Coal-tar, or aniline, dyes were discovered about the middle of the last century, but there are now in existence upwards of 60,000 of these dyes. Among other things artificial indigo is now made from coal tar and has gone far to replace the natural dye. Until the outbreak of the Great War the bulk of the coal-tar industry was German, but since 1914 strenuous efforts have been made by various countries, including ours, to develop substantial dye industries of their own. Up to recent years this industry has been always relatively unimportant in our country; in 1914 the production of synthetic dyestuffs amounted to something over 3000 tons, with a value of $3,000,000, and our importation of coal-tar dyestuffs was valued at over $900,000,000. Our domestic production consisted largely in the assembling into finished dyestuffs of semi-manufactured materials, but we have made a good many tons of aniline dye from benzol of domestic origin, this manufacture having started in 1910.

Effects of the Great War. When the Great War broke out in 1914, there was practically a cessation of coal-tar "intermediates"; all that came from Germany, constituting about 86 per cent of our foreign supply, was cut off altogether. But many American industries are dependent upon the use of artificial colors, and the situation for them was serious in the extreme. American chemists and capitalists at once took up the problem of relieving the impending stress and of laying the foundation for an independent American coal-tar industry. The enterprise was a difficult one, for the industry had to be built up from the bottom, but within three years the problem was solved. Our variety of colors is still somewhat limited, for a wide variety and perfection of quality can come only after a great deal of experience and experimentation. The

German dye industry was the result of long years of chemical research and technical training, and we could not hope to duplicate its performances offhand. The situation drove us back once more to the natural dyestuffs, use of which relieved the first acute stages of the color shortage; and we have also developed mineral dyes, such as chrome yellow.

Home production of dyes. The remarkable expansion of our dye industry since the summer of 1914 is one of the results of American initiative. We were making about 3300 short tons of dyes in 1914, but the output had increased to 15,000 in 1916, all out of American coal tar, and the industry has continued to expand. The national Bureau of Engraving and Printing, which produces all our paper money and postage stamps, managed to secure, early in the war, several shipments of dyes, which were used most sparingly and in diluted form; certain of the postage stamps issued for a time thereafter were considerably paler than they were before the character of the dye was changed. It is safe to say that at the present time the bulk of the artificial dyes consumed in our industries is made in American plants, by American labor, from our own raw materials.

CHAPTER XXIV

ELECTRICAL MACHINERY AND APPARATUS

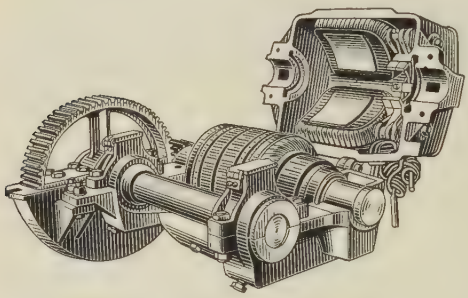
A new set of industries. This set of industries is almost too new to have a history, and there is about it so much of the technical that any adequate description is likely to be far from simple. But a survey of typical American industries that left this group out would be incomplete, and so we are including a brief chapter upon it. In general, this group includes the manufacture of the necessary machinery and all the appliances used in the generation, transmission, and utilization of electrical energy, but it does not take in the production of such things as poles (of wood or metal), glass or porcelain, or bare iron or copper wire.

Rapid development. This electrical industry was for the first time reported as a separate one in the Census of 1879, when it supported less than 1300 employees and produced an annual product worth less than $3,000,000. Then came the growth period, so that from 1879 to 1923 the number of establishments increased from 76 to 1671; the number of employees, from the above-quoted figure to 235,000; the capital invested, from $1,500,000 to a billion or more; and the annual value of product, to over $1,293,000,000. Here is evidently a very rapid advance; and while this business cannot compare in size with some others which we have described, it is so intimately bound up with the industrial and social life of twentieth-century America, and promises so much for the future, that it demands some space here.

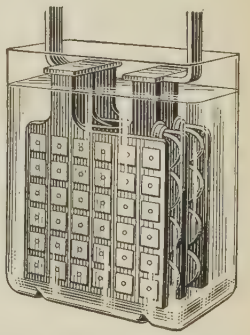
Advance by a succession of rushes. In a way the advance of this set of industries has been by a succession of rushes; concerning the telephone a writer in the Tenth Census says that statistics are really misleading where change is so rapid and violent — that at the beginning of 1879–1880 this business amounted to little or nothing, while at the end of the year it represented one of the great interests of the country. This statement is taken up by a writer in the Twelfth Census, who says that it applies all along the line in electrical industries and applications: in 1850 concerning the telegraph; in 1860 concerning the beginnings of dynamo construction; in 1870 concerning the stock-ticker and similar electric conveniences now familiar; in 1880 concerning electric lighting as well as the telephone; in 1890 concerning the vast exploitation of the electric railway; in 1900 concerning the adoption of the electric motor for power transmission and for factories, as well as for the automobile.

Dynamos. Dynamos form perhaps the most important single class of electrical apparatus, for they are necessary to generate the energy which other electrical machines and apparatus distribute and utilize. These machines have become much larger and more powerful since they were adopted, in connection with electric lighting, in 1870; and since 1885 the alternating current has been employed. In 1900 there were 9182 direct-current dynamos made as against 1345 using the alternating current, but the value of the former was only about $6,000,000, as against $4,000,000 for the latter. The average size of the latter variety was 254 horse power; of the former, 47 horse power. The direct-current machine is adapted to isolated plants, the alternating to comprehensive central stations; again, small-capacity dynamos are adapted to electroplating, to the charging of batteries, and so on. In general, with the great increase in number of dynamos since 1900, it is the alternating-current machines that have shown great increase in capacity; the other kind have decreased. Dynamos of direct current and small size have come into demand for household use and especially in connection with the automobile.

Motors. Electric motors have been known for nearly a century, but it was not until lately that they assumed any importance in the industrial world. Since 1890 they have shown a marked development; the census figures show that in 1890 New York City was using 360 motors in isolated plants — the horse power of them all amounting to only 310 — and that in the whole of the state outside New York City only 99 motors were in use. The rapidity of development since that time has been so great that the annual value of motors produced now is about $120,000,000. They have been applied to the operation of stationary machinery, for which small capacity was needed; these are the so-called "industrial motors." There has also been a striking increase in the production of small motors for operating electric fans or blowers; theaters, factories, and hotels, as well as dwelling houses, are now built with much greater attention to ventilation than formerly, and recourse to electricity is inevitable. The value of motors manufactured for automobiles has increased from less than $200,000 in 1900 to several millions at the present time.



A MOTOR



LEAD-PLATE STORAGE CELL

Storage batteries. To go into the construction of devices like the transformer is impossible here, but we may say that 36,000 transformers were being made annually by 1900, with a value of $3,000,000, while at present these figures have risen to 383,000 and $60,000,000 respectively. Then there is the storage battery. As early as 1900

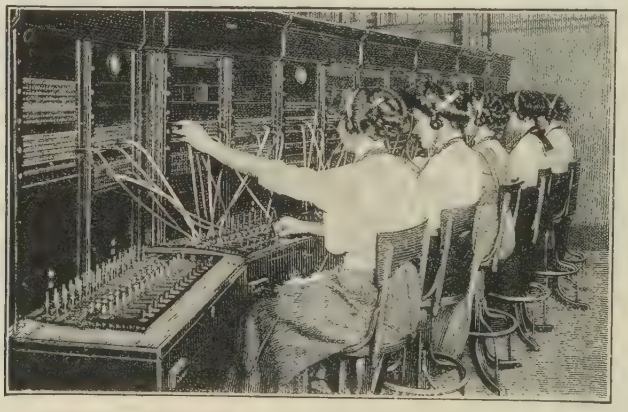
it was reported by the census that we had $11,000,000 invested in storage batteries for use in central stations for light and power, for street-railway power houses, and for isolated lighting plants. Since the opening of the century the value of batteries produced annually has increased from less than $4,000,000 to nearly $120,000,000, and in the first fourteen years of the century the number of dry primary batteries had risen from less than 2,000,000 to over 71,000,000 — this astonishing increase being explained by the rapidly growing demand for such products on the part of the automobile and the power boat. During the same period the value of storage batteries increased from about $2,500,000 to over $13,000,000, their most extensive use being in central lighting plants and in the electric-railway industry.

THE ARC LIGHT

Electric lighting. The manufacture of electric lamps and lighting fixtures is an important branch of the electrical industry. In the arc lamp the current forms a brilliant arc of light between two slightly separated carbon points, while in the incandescent lamp the current heats to a glow a nonconsuming filament sealed in a vacuum bulb. The former has been used most successfully for out-of-door illumination, the latter for ordinary lighting, replacing oil lamps and gas. The incandescent lamp is everywhere replacing the arc, the latter showing, since the opening of the twentieth century, an actual decrease. The manufacture of incandescent lamps is now one of the largest specialized departments in the electrical industry; especially are the tungstens on the increase, as a consequence of improvements rendering them durable and economical. From 1909 to 1923 the annual production of tungstens rose from less than 12,000,000 to nearly 233,000,000, while the incandescents with simple carbon filament were decreasing from 55,000,000 to 7,000,000.

THE INCANDESCENT LAMP

The telephone. Telephone apparatus is manufactured in this country to the value of $90,000,000 annually, a figure about four times as large as that for 1900. Formerly there was a very much centralized control over the production of telephone apparatus, resting on patents surrounding the system; but with the lapse of the patents a great deal of competition sprang up, resulting in further development for the telephone industry and transformation in the character of the apparatus. Telephone apparatus proper



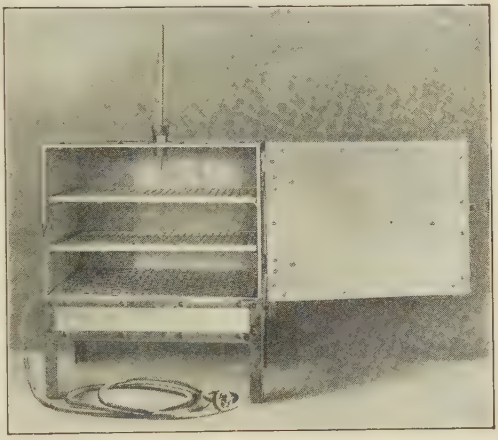
TELEPHONE CENTRAL, SHOWING SWITCHBOARD

does not include dynamos and motors, but such articles as transmitters, receivers, central switchboards, private-exchange boards, and telephone parts and supplies.

Electric heating. During the past decade there has been a good development in the use of electric-heating apparatus, the value of such manufactures — including electric irons, cooking devices, stoves, and ranges — having risen from $400,000 in 1904 to over $80,000,000 at present.

Development of electric power. Considerable interest is being manifested here in the subject of electric-power development, whereby the water power which we have may be transformed into electric energy and carried long distances to points of demand.

The conservation movement has a hand in this matter, for it has turned attention to the exhaustibility of other sources of power. It is estimated that our potential water power is somewhere between a minimum of 20,000,000, and a maximum of 54,000,000, horse power. We have seen that the great bulk of the country's water power is located very far from the industrial centers. Power can be transmitted over a radius of several hundred miles and will, no doubt, extend its range as time goes on; but, making due allowance for the progress of science, it would appear that the great bulk of our water power is not within striking distance of our great industrial centers.



AN ELECTRIC DRYING-OVEN

Radio apparatus. It would be difficult to find an industry whose development can compare, in an equal time, with that of the radio in recent years. The industry was unknown a few years ago, but the annual value of its product to-day is not far from $50,000,000.

Location of the industry. Establishments engaged in manufacturing electrical machinery, apparatus, and supplies are to be found in nearly all of our states, but the industry is highly developed and centralized in the following six: New York, Pennsylvania, New Jersey, Massachusetts, Illinois, and Ohio.

PART VI. TRANSPORTATION

CHAPTER XXV

BEGINNINGS OF THE AMERICAN TRANSPORTATION SYSTEM

Importance of the distribution of products. It is impossible to overemphasize the importance of transportation as a factor in industrial development — in fact, for the development of civilization in general. The first operation in economic life is production, to which, in its various forms, we have given considerable attention in the foregoing chapters. But the reason for production is that products may be consumed. And then there is the connecting link between production and consumption, which is distribution; that is, moving the products to the points where they are wanted. Distribution and its problems enter immediately — unless the case is one of a Robinson Crusoe or a very small and isolated group of people, where things are produced and used in the same locality. Even in such a small group there is likely to be some distribution, for the members will fall naturally into the doing of that for which each has a special bent; that is, there will be division of labor whereby one member produces only one thing and another another thing. Then the members will trade with one another, and this represents distribution.

Trade between specializing groups. But there are plenty of cases where the whole of a small group or tribe will specialize in the production of a single product, say arrow poison, and another

neighboring tribe will make hammocks. The former makes more arrow poison than it can possibly use, and the latter a superfluity of hammocks. But such products could only be stored up in useless amounts unless they could be exchanged and distributed to places where they are wanted. Trade is bound to come in; it allows specialization, and so accumulation of skill, as well as economy of time, labor, and materials. But this helps along the development of civilization, and the exchange of ideas that follows upon trade relations gives further momentum to that development. No single isolated man or small group of men ever succeeded in working up anything deserving the name of civilization; it takes numbers and the contact of numbers to do that. Thus distribution of product is essential to the rise of an economic life of any import and to the development of general civilization itself.

Need of transportation. But exchange of products, even on the most local scale, demands that these products be carried from one place to another. The arrow poison and the hammocks will not go of themselves. If there is to be distribution of material products, there must be an immediate development of transportation. Any sort of developed production is useless without distribution of the product by way of transportation. These facts are very simple and obvious, but they are essential — and it is often the simple and obvious that we are likely to lose sight of. This situation might be less simply expressed by saying that even in the very beginnings of the industries, as well as throughout the period of their development, the extent of the market has always been a limiting factor in production.

Development of transportation. When the transportation facilities were slight and freight rates high for even poor and slow deliveries, large districts of this country could not be brought within reach of the outside market at all. In this day of cheap and rapid transfers, by water and by rail, we are likely to take for granted much that has been the product of long and painful growth and to forget that it is our transportation system which has enabled us to assemble upon our dining table, for example,

the products of the four quarters of the earth. These products have to be brought here, and then the countries of their origin have to receive another set of products to pay for them. No country's wealth can be utilized to advantage unless there are good transportation facilities. Our great mineral resources would still lie undeveloped and all but unopened, and our agricultural wealth in the Central West would still remain potential rather than actual, were it not for the development of transportation. The presence of such resources has stimulated the development of transportation, which has then permitted their utilization; partial utilization has then made desirable, or even necessary, a fuller utilization, and this has called for and into existence improved transportation; and so the process has gone on rolling up upon itself.

Early American transportation. A general history of the development of transportation would contain many interesting and diverting episodes, as well as much solid and valuable information; but in this place we are confining ourselves to America, and shall begin with a brief account of the transportation system, if it may be so called, of the Indians who inhabited the country now known as the United States. The natives of Mexico and Peru, being upon a much higher plane of civilization, had of necessity developed methods that were far ahead of those of the northern tribes; but it was the latter that the colonists met with and that entered as a factor in the early industrial history of our country.

Indian transportation. As the Indians had never advanced very far in industrial development, so they had made but small progress in trade and transportation. Their industrial organization was very well adapted to their conditions of life, and it called for little exchange. Railways and canals would have been as useless to them as their trails and water vehicles would be inadequate to handle the great volume of traffic which to-day moves back and forth across the continent. Naturally the first essential to transportation is a way or road, and the first and most obvious road is a waterway; it is already cleared, it is smooth, and on it friction,

which is the barrier that stands in the way of the movement of bodies, is reduced to a minimum. And the vehicle for such a road is a boat of some sort. Most of what deserves the name of transportation among the Indians was water transportation.

Canoe journeys. The waterways were abundant and convenient for them; lakes and rivers existed everywhere. Long journeys could be made with only an occasional portage. Canoe

LIGHT-WEIGHT INDIAN CANOES

navigation was possible from the north to the south of the country by way of the Mississippi and its tributaries, and a trip could be made across from east to west by the St. Lawrence, the Great Lakes, the upper Missouri, the Columbia, and their tributaries. Not that the Indians often, or ever, made such voyages, but the intervening space was pretty thoroughly cut up by streams and other bodies of water navigable to boats of little draft, like the canoe.

Types of canoe. Now the canoe, as someone has said, "was to the Indian what the camel or horse was to the Arab." The style of this craft differed according to the environment: in the northern regions the rapids and portages made it desirable to

have a light craft, and the bark of the birch was present to afford the suitable material; in the region of the Gulf and Caribbean, on the contrary, the canoe was made from a single tree trunk, hollowed out by fire and the stone ax, or adz — the so-called "dugout." Larger and slower boats were made for the women and children and the baggage, and in these was transported what freight there was. It is now known that the Indians conveyed

A DUGOUT CANOE IN THE FLORIDA EVERGLADES

Courtesy of American Museum of Natural History, New York

articles of exchange, such as stone and pipe-clay, across considerable stretches of country, but it must be realized that such commodities were passed on from hand to hand and that there were no professional peddlers of wares who covered a long route. Whatever trade there was, was within a rather short radius.

The trails. The Indian used also land routes, or trails. These were laid out with reference to such matters as the location of enemies, of hunting grounds, and, later on, of the trading posts and forts of the white man. The historical importance of these trails consists in the fact that they became the roads of the early settlers and later developed into the commercial highways of a succeeding age. They were little more than paths; but they were of much

importance to early explorers, missionaries, and traders, for they were laid out, doubtless without conscious calculation, on the lines of least resistance. For example, the trails which led from the Atlantic seaboard across the mountains went through the valley of the Mohawk, to the north, and through the lower passes, farther south.

Railways follow the trails. The routes of all the main Indian trails are to-day occupied by important railway lines: the New York Central, the Lake Shore, the Pennsylvania, the Toledo and Ohio, the Hocking Valley, the Norfolk and Western, the Cincinnati, Hamilton, and Dayton, and other railroad lines followed these trails because they were the lines of least resistance and therefore the lines of business advantage. All of these trails had special names which were pretty well known some decades ago but which would now convey no meaning to anyone not a local resident of the district. But it is interesting and significant to realize that when the white man came he was led to locate his dirt roads and railroads along the Indian trails because they were the natural highways of the country.

THE BURDEN STRAP

Indian land transportation. The Indians did little or nothing to improve the beds of their trails; few or no bridges were built by them, for the need of these came with the introduction of wheeled vehicles, which were unknown to the natives. The Indians, indeed, had few contrivances to assist land transportation, and no strong beasts of burden or draft at all — unless the women

might be regarded as such. The dog was used to some extent. There were sledges of a crude order, but the burdens that were borne were usually for the back and were partially supported and steadied by a burden strap worn over the forehead. The horse was a great boon to the Indian, when it had been introduced from the Old World, and, in imitation of the whites, he employed it as a pack animal. The only vehicle invented for the horse to drag was the so-called "travois"; tent poles were lashed on either side of the horse and trailed on the ground behind, the ends bumping and scratching over the country, and upon these was strapped the baggage, often with the women and children on top of the whole. Dogs also were thus loaded; the sign for "dog" in the Indian sign language was two fingers drawn across a surface.

THE TRAVOIS — A MEANS OF INDIAN TRANSPORTATION

Colonial transportation. The early settlements clung closely to the water, being established along the seacoast, on islands, or on navigable rivers — the Puritans on Massachusetts Bay, the Dutch on Manhattan Island and along the Hudson, the "Colonies on Chesapeake Bay," and so on. Natural watercourses — for the colonists as for the Indians, and for the same reasons — formed the ways of transportation. And as the interior was penetrated, lines of least resistance lay up the streams — for example, the Delaware and the Potomac. If a settlement was made away from these natural means of communication it remained isolated and had to be

self-sufficient in high degree. However, this was the character of the frontier settlement in any case, and there came to be many small groups of population, access to which was by foot along the Indian trails. To such places no bulky goods could well be carried, and the cost of conveyance, even of small articles over much distance, was prohibitive. After a while, however, when necessity demanded it and when some capital had been accumulated, the individual landowners, at first, and then the local and general government of the colony in question undertook to cope with the problem of creating a better system of transportation. Here they encountered a set of physiographical conditions which were very significant to them and which cannot be disregarded even at the present day.

Barriers to communication. The earliest settlements had been made, of course, on the seaboard, and they were necessarily more or less isolated from one another because of the practical absence of means of communication, especially by land. The sea was the only highway of the time, and in the absence of coast surveys and adequate lighthouses this was not available on all occasions. And when these earlier settlements began to expand they were obliged to spread along the coast rather than back into the interior. This was on account of the Appalachian mountain wall in the rear, which formed a barrier very difficult to pass. A few trails led into the back country, and there were passes through the mountains, but even after small settlements had been established west of the Alleghenies, communication with the coast was infrequent and irregular.

Transportation and the settlement of the West. The further development of the settlements west of the mountains was really conditioned on the development of transportation, for there could be no very great advance unless the frontier kept in touch with the settlements of the East, and especially with their markets. But from 1750 to 1800 their isolation was scarcely broken, and they lived for the most part unto themselves, being but little regarded by the more populous communities of the coast. The

early history of railroad transportation consists largely of accounts of efforts, originating now in the East and now in the West, to surmount the mountain barrier and to establish regular means of communication and transportation between the Ohio and Mississippi valleys and the Atlantic seaboard.

Colonial roads. The early settlements were soon obliged to give some attention to local roads. Where necessity demanded, individual landowners would work by themselves or would coöperate in connecting up adjoining properties. Then there were provisions made by the colonial governments for road-making, but it may be said, in general, that these resulted in but few roads. And settlements had been established for a long time before there was enough community of interest to prompt adjoining colonies to coöperate in building intercolonial roads; there had first to be formed a real necessity for such. There was, besides, an insufficiency of capital to warrant the undertaking of extensive road-building; and racial and religious differences, as well as differences in the forms of colonial governments, tended to keep people's interests divergent and so to retard the movement toward establishment of communications. Trade is a solvent of this sort of mutual indifference, if not hostility; but trade was not yet strong enough to discharge its traditional function along these lines.

Insufficiency of the roads. As late as the time of the Revolution there was not a good road of any considerable length in any part of the country, nor were there permanent bridges over the large streams. Over most of the American territory no improvement whatever had been made except the addition of the horse. But a marked improvement in available water craft was secured by the use of ships, and a few sections had fair roads. The best substitute for permanent bridges, at points of greatest importance, such as Philadelphia, were floating bridges sustained by boats. Land travel, as we have seen, was almost universally on horseback. The last century was well advanced before traveling in carriages became at all common, ladies as well as gentlemen

making all their ordinary journeys on horseback or in heavy farm wagons. Some leading men in the colonies saw the need of roads, but they lacked the influence to make their views heeded — willingness to pay taxes for a public utility is a characteristic of older and more experienced societies. The factors which held the movement back are said to have been the general ignorance of the period as to the best methods of road construction, the indifference or hostility of many shortsighted landowners, who would not give up any of their land for roads, and the scarcity of labor and capital actually available for road construction.

Post roads. The postal service must not be overlooked as an influence on road-building. Intercolonial post roads, which were in reality nothing but paths, began to be opened in the latter part of the seventeenth century, the mails, of course, being carried on horseback. Previous to the opening of these routes mail was sent from one community to another by chance travelers. Postal communication was open between New York and Boston about 1673, the rider who conveyed the mails making the trip in three weeks. A postmaster-general for the colonies was appointed in 1692, but nothing much came of the creation of this office because of "the dispersed condition of the inhabitants." By 1695 eight trips a year were made with the mails between the Potomac and Philadelphia. Soon after the close of the Revolutionary War there were to be found in the United States only seventy-five post offices, and the post roads aggregated less than two thousand miles. Between New York and Boston mails were being conveyed in summer three times a week and in winter twice, the trip requiring, on the average, about five days. Two days were necessary to make the distance, one way, between New York and Philadelphia, and five mails a week were forwarded. In some parts of the country the post roads were still only paths, some, in fact, being no more than improved Indian trails; in spite of efforts to improve conditions on the postal routes the roads were still in deplorable condition toward the close of the eighteenth century.

Ferries and bridges. With the real opening up of roads it was necessary that ferries be established where the streams could not be forded; and bridges succeeded ferries when necessity pressed hard enough. Private parties often secured a grant from the colony and ran ferries, and later built and operated bridges; or a town might be owner and operator. As early as 1636 authority was granted for a ferry at Beverly, Massachusetts, which was operated by the town of Salem; not until 1787 was there a bridge at this point. Bridges were small and often shaky affairs and spanned only the smaller streams; not until after the Revolution was bridge-building taken up on a more ambitious scale and solid wood and stone structures erected.

AN EARLY TRANSATLANTIC STEAMSHIP

Sea traffic. The sea traffic of colonial times was a limited commerce between the colonies and was carried on in sloops, schooners, and other small vessels; the vessels for transatlantic trade were for a time almost exclusively foreign-built. The largest ships in early colonial times seldom exceeded 100 tons or so. In 1769 the colonies built and launched 389 vessels, 113 square-rigged, and 276 sloops and schooners, aggregating 20,000 tons burden. Of these Massachusetts built nearly half, with New Hampshire and Rhode Island next, while New York had only 5 square-rigged ships and 14 sloops and schooners, aggregating in all 955 tons. Pennsylvania owned 1344 tons, Virginia 1249, North and South Carolina 1396, Connecticut 1542, while Georgia had 1 sloop and 1 schooner whose combined measure was only 50 tons.

Inland water transportation. For the inland waters there were smaller craft, such as skiffs, rafts, and arks. The flatboat came

into use on the Ohio and Mississippi. During the latter part of the eighteenth century and the early part of the nineteenth nearly all the adventurous men of the West near the Ohio River took part in flatboat movements. Many got their start in life by building a flatboat, loading it with produce, and making a trip to New Orleans. The historic case of this sort of enterprise is that of the youthful Abraham Lincoln, an account of which is to be found in any of the Lincoln standard biographies. The flatboats

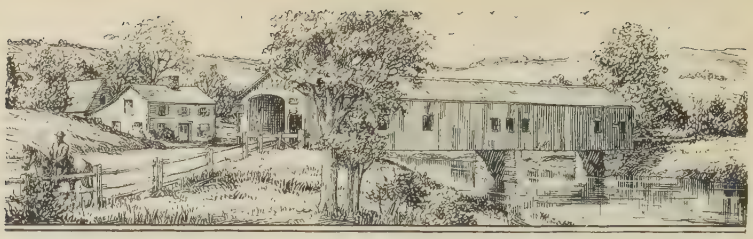
EARLY STEAMBOATS ON THE HUDSON

and some of the other river craft could be operated only downstream, so that it was a common practice, as the Lincoln story shows, to build these boats in rather flimsy fashion — little better than rafts — and sell them at their destination for what the lumber was worth, the owner and crew returning home on foot or in some roundabout way. The incidents of raft life on the Mississippi are touched upon in graphic style by Mark Twain, in his "Tom Sawyer" and "Huckleberry Finn." For rafting went on, as a supplementary form of transportation, long after the introduction of the steamboat.

The coming of the steamboat. It remained for the first quarter of the last century to see the steamboat in practical operation upon our rivers, lakes, and tidewaters; its introduction revolutionized

A MODERN OCEAN STEAMER

the system of water transportation, as the steam locomotive did the land transportation. Old methods persisted in out-of-the-way places, but the application of steam ends the first period of the development of our transportation and therefore concludes this chapter.



CHAPTER XXVI

TURNPIKES AND CANALS

Growth of interest in road-building. General interest in improving land transportation seems to have been stimulated soon after the Revolution; numerous schemes were then devised for building turnpike roads and bridges. The movement was originated by private individuals, but later on the state governments fell in with it. The private individuals were interested in making money from tolls to be charged on the roads, and applied to the states for permission to construct roads and bridges to connect the most densely populated districts along the seaboard, and the interior with the coast. A temporary check was given to the movement by the European wars, about the close of the eighteenth century, which opened great opportunities for American shipping and thus diverted capital and interest. But population continued to increase and to move westward, so that a demand came back to the East for better connections, and the movement for road-making and river improvement revived strongly at the opening of the last century.

Successful turnpikes. This movement was stimulated by the success of the Philadelphia and Lancaster turnpike, opened in 1794, which was the first extensive enterprise of the sort in the country. It connected the Schuylkill River with Lancaster, sixty-two miles distant, and was later extended to the Susquehanna River, at Columbia, under the name of the Lancaster and Susquehanna Turnpike. The main stockholders of such turnpikes were

the landowners adjacent to the road and the merchants who meant to use it; and the state government determined the amounts of the tolls that were to be charged.

Road companies and state enterprises. Throughout the first quarter of the nineteenth century the building of roads by private companies was a regular mania in the seaboard states. The states themselves took a hand in the matter and voted money for road-building, set aside the proceeds of land sales, and even permitted lotteries to raise money to carry on the work — especially in the case of connecting up the frontier settlements, where the prospective income from tolls was not large enough to tempt private capital. Before 1800 the states had chartered very few road companies, but by 1811 charters had been issued wholesale: 26 in Vermont; over 20 in New Hampshire; upwards of 50 in Connecticut; in the whole of New England about 180. By 1811 New York had chartered 137 companies covering a distance of 4500 miles; and a third of this had been built. New Jersey had 30 companies and Pennsylvania a few more. This was the beginning; and the mania continued a little beyond 1825, when the enthusiasm for building canals took its place. An agitation arose for the Federal government to take a hand in this matter of internal improvements, of which more will be said presently.

Road-building not profitable. But the building of turnpikes did not prove to be a very profitable venture; the tolls charged, though high as compared with present freight rates, were not enough to enable the companies to pay large dividends, because the bulk of the earnings had to be expended in making necessary repairs. Inasmuch, however, as many of the stockholders were the landowners and the merchants, they received some indirect return outside of dividends — the landowners saw the land adjacent to the roads increase in value, and the merchants reaped the benefit of improved facilities for transportation, which widened their markets.

Costs of transportation. On the whole, however, it may be said that the roads did not accomplish very much toward reducing

the cost of transportation. It is said that, taking the country as a whole, transportation of merchandise cost $10 per ton per hundred miles. The rate from Philadelphia to Pittsburgh, when the through line by land was established, was about $125 a ton; in 1807 the charge between New York and Buffalo was $100 a ton, and twenty days were required for the transfer; that is, the New York-Buffalo charge was three times the market value of wheat

SCENE ON AN EARLY AMERICAN TURNPIKE

and six times that of corn. These figures show, by contrast, the immense value of later transportation improvements. Articles that could not stand such rates were excluded from the market. The bad state of the roads and the high rate of tolls accounted for such high costs.

Bridge companies. Turnpike-building naturally drew with it bridge-building. In a great many cases the early bridges were built by corporations and were toll bridges; some of them still exist. Bridge companies, like road companies, had their hard times, and lotteries were occasionally authorized by the state to

raise additional funds. In the Eastern states, notably in Massachusetts, bridges, except for the stone piers and abutments, were made mostly of wood, and their only defect was lack of durability.

Gallatin's report. During the first part of the nineteenth century there was abundant Federal revenue, and a movement was started to use this treasury surplus to build roads and otherwise to improve transportation. Albert Gallatin, Secretary of the Treasury, was instructed to draw up a report showing the state of roads,

AN EARLY AMERICAN TOLL BRIDGE

bridges, and waterways and to present a plan for providing the country with an adequate transportation system. From this report important facts can be gathered as to the conditions of making such improvements. The roads cost between $1000 and $14,000 a mile. Fifty turnpike companies had been incorporated in Connecticut alone since 1803, and 770 miles had been built. New York showed the largest capital investment, and roads extended in every direction, but mainly from settlements on the North River towards the Susquehanna and the Great Lakes; the road from Albany to Schenectady had cost at the rate of $10,000 a mile. South of the Potomac there were few artificial roads undertaken.

Other public works advocated. This report of Gallatin's expressed the opinions of many of the leading men of the country, and its recommendations, had they been followed out, would have contributed strongly to our industrial development. Gallatin was in advance of his time, but the main features of his plan deserve to be known and compared with what actually took place later on. He wanted a canal from Boston to North Carolina across the principal capes, except Cape Fear; a great turnpike from Maine to Georgia, along the whole extent of the Atlantic coast; the construction of four artificial roads from four important Western rivers to the nearest corresponding coast streams; the improvement of the navigability of these coast rivers; a canal around the falls of the Ohio; an improvement of roads to St. Louis, Detroit, and New Orleans; inland navigation between the North River and Lake Champlain and, by canal, between the former and Lake Ontario; a canal around Niagara Falls; and the opening of navigation for sloops from Lake Ontario to the extremities of Lake Michigan. The military, commercial, and political advantages of these works were all emphasized, and they were to cost, with some other local improvements, about $20,000,000. The scope and daring of Gallatin's vision are remarkable.

The Cumberland Road. But this report came to Congress at an unfavorable time, shortly after the Embargo was laid and when the treasury surplus was wasting away. The nation's attention was directed toward other things than internal improvements, and the only enterprise of any magnitude that was embarked upon was the Cumberland Road. This highway connected Fort Cumberland on the Potomac with Wheeling on the Ohio; it was commenced in 1811 and completed in 1818, later being extended as far as Springfield, Ohio, and finished to that point. It was partly completed to Vandalia, Illinois, and surveys were made as far as Jefferson City, Missouri. This road responded to a real need and became one of the great highways connecting East and West. It stimulated the trade between Baltimore and the Western country at the expense of Philadelphia.

The Wilderness Road. Another important road leading to the West, but not built by the Federal government, was the Wilderness Road, which played a prominent part in the settlement of the West, for along it moved a stream of population, by way of the Cumberland Gap, into Kentucky and Tennessee. The original trail was laid out by Daniel Boone in 1774–1775, to the falls of the Ohio; it developed from a trail to an immigrant path, then to

SCENE ON THE NATIONAL ROAD

a route for pack horses, and at length to a wagon road. The legislature of Virginia appropriated money for improving the road, and private funds also were raised, yet by the time of the War of 1812 it was still in very primitive condition. We have said that this was the great immigrant road. Of the 75,000 inhabitants of Kentucky in the year 1790, more than nine tenths were said to have entered by way of the Wilderness Road. In 1800 this population had increased to over 220,000, and a large proportion of the increase had, again, arrived by the same highway. "It was this moving host," says one writer, "that gradually wore a spotted trail into an immigrant trail, a pack-horse route, and a wagon road."

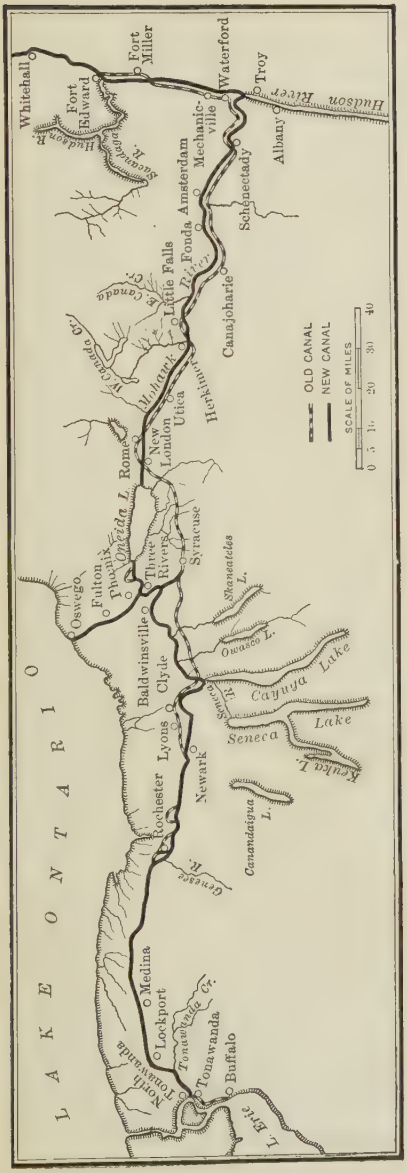
Modern road-building. We scarcely need to go into the matter of modern road-building, as it is familiar to all, except to emphasize the influence exerted toward betterment of roads by the increasing use of the automobile. The line of progress has been progressively to straighten and smooth the roadways, and the straightest and smoothest is, of course, that road which consists of ribbons of polished steel — but this sort of road we reserve for a chapter by itself.

Canals

Rise of the canal-building craze. General Washington was impressed as early as 1772 with the necessity of building canals and improving river channels; and it will be recalled that Gallatin recommended not a few canal projects. But the real era of canal construction was the second quarter of the nineteenth century. Canals were not unknown in this country even in the eighteenth century, but it was not until the Erie Canal had been built and finally put into operation, in 1825, that the great impetus was given to the projection of other works.

How to link East and West. The westward movement of population during the first two decades of the last century was sufficiently striking to catch the attention of everyone, but especially of those far-seeing men who were looking forward to the future industrial importance of the West. It became the ambition of leading merchants, notably in New York, Pennsylvania, Maryland, and Virginia, to secure a predominant influence over Western trade. But nature had provided only one outlet to tidewater for the products of this region, and that was by way of the long river-route to the Gulf; for not much attention had as yet been drawn to the St. Lawrence route. The Allegheny Mountains were regarded as a most formidable barrier to travel and trade. The problem and concern was how to link the West with the East by an adequate system of communication and transportation.

The Erie Canal. For a time roads were considered to be the only practicable means to this end; but when it became generally



ROUTE OF THE ERIE CANAL

known that canals were a good device for meeting commercial needs, and that they were superior to any other known means of transportation, new schemes were brought forward from various quarters to connect the West and East by canals. Great enthusiasm seized upon certain districts; while Pennsylvania, for example, was talking about the matter, New York was acting, and the Erie Canal was the result. Its successful completion, in 1825, and its operation gave New York a decided advantage in the Western trade. New York had a considerable advantage of position, for it had been unnecessary to pass over the mountains in reaching the West, nature having provided the Mohawk Gap; so that when Pennsylvania later built her competing route, partly by rail and partly by canal, her defeat was inevitable, for there was no natural depression in her mountain ranges, and her extra costs and

other difficulties formed a handicap which prevented her from meeting the competition of the New York canal.

Popularity of canals. The canal-building mania was not, however, confined to projects for connecting the West with the East. It was confidently believed by many during this period that canals were the last word in transportation and that the sooner the country was copiously supplied with them the better. It was also the conviction that they were going to be high-dividend payers. It was even argued in some of the states that the receipts from tolls on the state canals would go far toward paying the major expenses of government and defraying the charges for public education. Canals were thought to be a sort of wonderful discovery leading to general ease of life and felicity.

The canal era. It was the states, not the corporations, that embarked in most of the enterprises of the canal era. The Erie Canal was built by the state of New York and operated as a public work, and expense was not spared to make it a worthy one. It was 363 miles in length, 4 feet deep, and had a width of 40 feet at the top and 28 at the bottom. Pennsylvania built in all over 900 miles of canal between 1826 and 1842. The greatest amount of canal mileage at any time in our history was 4468, built at a cost of $214,000,000, mostly by state governments. Nearly all the canals were financial failures, and, built as they were in the years of financial stringency following the panic of 1837, some of them brought their states to the verge of bankruptcy. It was the coming of the railroads, about the middle of the century, that caused the abandonment of many canals. Some canals were bought up by the railroads and operated for a time; a few, like the Erie, have continued to exist, and some of them perform an important local, or even more than local, function clear up to the present day. Aside from the competition of the railroad, there were several causes for the failure of the canals: freshets, especially in the spring, rolled up extraordinary expenditures for repairs; they could be operated only during the open seasons, being frozen up in winter; many were built as a

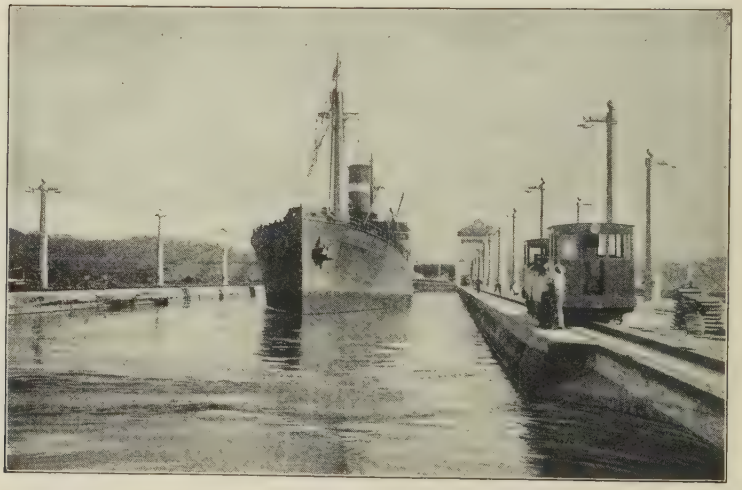
consequence of log-rolling of one sort or another, had never been needed, and were doomed from the outset. It has been said that there was a much larger percentage of absolute failures, together with a much smaller percentage of decided successes, in canals than in any other important class of American public works designed to promote the movement of passengers and freight.

Services and improvement of the Erie Canal. The Erie Canal, connecting the Great Lakes with the ocean by way of the Hudson River, was, on the whole, the supreme effort in our canal-building; it has been, in fact, the most important canal this country has ever constructed, unless the Panama Canal be excepted. It contributed a large share towards making New York the metropolis of the Union. For a long time it was able to withstand the competition of the railways; up to 1866 the canal traffic comprised about 60 per cent of the freight movement across the state of New York. A marked shrinkage in business followed between 1866 and 1895. During all this time the railway traffic greatly increased, for the railways were kept up-to-date and the canal was not; neither the size of the channel nor that of the locks was increased after 1862. A plan for enlarging and rebuilding the Erie Canal was adopted by the state of New York in 1903 and completed in 1918. It is to be kept as a first-class waterway and used by steam-towed barges with a capacity several times that of the boats formerly used and with a speed greatly increased over that of the latter.

The Panama Canal. The Panama Canal is not within the United States proper, but it should receive mention here. The idea in building it was, of course, to connect the two oceans and to obviate the long voyage around Cape Horn, just as the Suez Canal obviated the necessity of doubling the Cape of Good Hope. The thought of piercing this isthmus had been in men's minds for over a century, and the French had already spent millions upon the project before it was undertaken by us. A strip of territory ten miles wide, known as the Canal Zone, was purchased by the United States from the republic of Panama, and a canal

of the lock type, with a summit eighty-five feet above sea level, has been constructed. This has been a great engineering undertaking, and the world will watch with interest to see whether it justifies all the expectations of an economic and political order which its advocates prophesied.

The improvement of natural waterways. The increasing volume of traffic on our railways — more than they seem able to take care of — has turned attention recently to the question of



MIRAFLORES LOCKS IN THE PANAMA CANAL

improving our natural waterways to supplement the railways. This is, in a sense, a return to an older system of transportation which the railways had almost driven out. Some people think the time may soon come when we shall regret that the canals have been so generally closed up. Parties in the Central West and others have been urging Congress to connect the Great Lakes with the Mississippi by a canal of large dimensions, some advocating a fourteen-foot waterway from the Great Lakes to the Gulf, utilizing, of course, the Mississippi and other streams — the fourteen feet to be a minimum at any point.

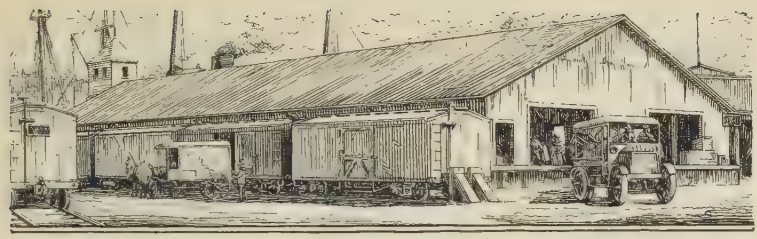
What the waterways can do. It seems fair to say, in regard to such projects, that we cannot expect always to have only the best and swiftest means of transportation. We have got to the point where our life is a continuous rush and have somewhat lost the sense of proportion; we insist on speed at every point, impatiently expecting to receive heavy, imperishable freight about as quickly

A BATTLESHIP PASSING THROUGH THE PANAMA CANAL

as other kinds, discarding the sailing vessel in favor of the steamer at almost every point. But all this speed costs that which cannot be replaced; the coal the steamer burns is here and is gone, while the breezes that carry the sailing vessel are here, in undiminished force, as they were when men first began to sail. It is coming to be seen that a careful distinction between kinds of freight — whereby some of it can be transferred rather slowly by water, while the railroads are freed to rush to its destination that sort of freight which cannot wait and much of which is now damaged

by being held up on account of congestion — will represent an economy and conservation of resources to which we have hitherto been comparative strangers, but to which we must sometime come. It is a question of utilizing all varieties of resources in their degree, rather than of employing only one because it is the best.

Retirement of the states from building state works. The crisis of 1837 was the beginning of the end of state works along the line of transportation improvements; it had come to be realized that many of the enterprises were premature, and that on some of them the state money had been recklessly squandered. With the coming of the railroad a movement rose in the various states for selling the canals, and for the entire withdrawal of the state governments from the building and operation of internal improvements. The field was thus left clear for the railway to develop as the enterprise of private individuals and corporations.



CHAPTER XXVII

RAILROADS

The canal era and the railroad era. A few thousand miles of railway were built before 1850, and almost no new canal enterprises were undertaken after that date. The railway succeeds the canal, but for a time the two overlap; there is no point of time when it can be said: Here the canal ends and the railway begins. There are no such theatrical changes in human affairs — no sharp lines of distinction, but rather zones of transition, when the old is not yet gone and the new is not yet here.

Beginnings of the railway. Being younger and industrially less developed, this country was much behind the mother country in railroad construction. In England crude attempts to use rails for purposes of transportation had been made before the middle of the seventeenth century. For a long time the vehicles used were ordinary road wagons, and the power employed was varied, including horses, gravity, and wind acting upon sails. After the invention of Watt's steam engine, in 1769, it was suggested that steam power could be used for propulsion; the stationary engine was first tried, and then the locomotive. The superiority of the latter was demonstrated in 1829, when George Stephenson's "Rocket" won a prize of £500 offered by the Liverpool and Manchester Railway for a locomotive engine of a speed not less than ten miles an hour; the "Rocket," though weighing only four and one-fourth tons, made twenty-nine and a half miles an hour on a level track with a load of twelve and three-fourths tons.

Beginnings in America. In this country tramways operated by animal power, gravity, or stationary engines were employed before railroads, as the term is now understood, were known. Sails were used here also. The pioneer railroad in this country is generally conceded to have been the Baltimore and Ohio; it was, at any rate, the first road in the nature of a public utility. Its first rail was laid on the Fourth of July, 1828, by Charles Carroll, reputed to be the only living signer of the Declaration of Independence, and in 1830 the first division of the line was open for general transportation purposes. This was at first a horse-car road,

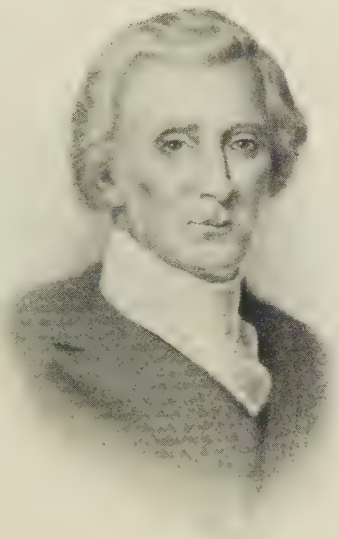
LOCOMOTIVE BUILT BY GEORGE STEPHENSON

AN OLD-TIME STAGECOACH ON RAILS

but locomotives soon took the place of the animals; the cars were at first small and open, like stagecoaches, but later on were larger and mounted on trucks. Of course the whole apparatus was on a

scale that appears to us now as ridiculously minute; the roadbed was poor, and the rails were hardly more than strips of metal. But it was gradually borne in upon people's minds that it was not the canal but the railroad that was to be the last word in the evolution of transportation.

The earlier lines. Numerous railroad lines were begun shortly after the Baltimore and Ohio. The New York Central system originated in the Mohawk and Hudson, which opened, in 1831, seventeen miles of road between Albany and Schenectady. A little later Boston was connected with Providence, Lowell, and Worcester, and in 1841, by way of Worcester, with Albany. The following year saw a Boston-to-Buffalo connection. The germ of the Pennsylvania system, from Philadelphia to Columbia, was put into operation in 1834; and by 1837 Philadelphia was connected with New York Bay and Baltimore. In 1838 the Reading railroad was in operation up the Schuylkill valley. The first railroad in the South was a South Carolina line running from Charleston to Hamburg, a settlement opposite Augusta on the Savannah River; this road was opened in 1837, was one hundred and thirty-seven miles in length, and enjoyed for a brief time the distinction of being the longest railroad in the world.



CHARLES CARROLL

The first lines were local. The earlier railways were not designed to be arteries connecting West and East; with few exceptions comprehensive schemes did not underlie the early

railroad enterprises; most of the lines were local and, being of different gauges, were not available for long shipments. When the idea developed of linking up the short separate lines into systems, it was found that there were many different companies operating the roads, each in its own way; nothing was uniform. In 1850 there were seven different companies operating lines connecting Albany and Buffalo. This matter of a non-uniform gauge was

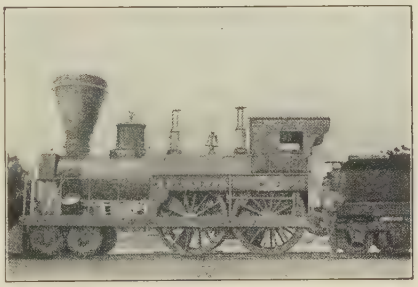
"JOHN BULL" LOCOMOTIVE — AN EARLY AMERICAN LOCOMOTIVE

always a great nuisance; there was even developed a sort of telescopic axle permitting the adjustment of the wheels to tracks of different gauge.

Engineering difficulties. In the laying out of the early railroads the engineer had to keep in mind constantly the necessity of low initial cost of construction. Hence the first American railroads showed sharp curves, steep grades, and irregular courses. It was easier to follow the old road or trail than to strike out on a new one; but the early highway was, as we have seen, often based on an Indian trail, or even, as in the Middle West, on a buffalo trail, neither of which was noted for its directness. And where the old dirt roads had been diverted from these more or less haphazard lines, it was less for the purpose of straightening the course than of meeting the wishes of some person or community which had foresight enough to want the road and influence enough to get it deflected in that direction. This sort of course

introduced engineering difficulties that were elsewhere — for instance, in England — unknown. The resources of American mechanics were taxed to the limit, and all sorts of devices were adopted to make the engine stick to the track; on the other hand, however, many permanent improvements were made, such as the swivel, or bogie, truck, which permits of sharp turns.

The early locomotive. The early locomotives were not very strong; for example, it is said that on the Mohawk and Hudson the engines had to be taken off in winter and horses used in their stead, and in some cases it is recorded that passengers often had to get out and help start the train by pushing. The locomotives were practically all wood-burners, as they were introduced prior to the coal age. Stories are told of the stopping of a train to allow the fireman to cut wood, the engineer and well-posted passengers getting out their fishing tackle and enjoying themselves the while. The smokestacks had to be high, and at many of the overhead bridges they had to be taken down; and so it became a custom for a watchman to examine bridges after a train had passed, carrying with him a bucket of water in case the engine had set fire to the bridge. And the roadbeds were too flimsy to support a locomotive and train of much size; it was thought that heavy locomotives would destroy the bed, and their size was kept down. It is not so surprising that the popular mind came but slowly to an appreciation of the nature and possibilities of the railroads. Apparently the railroad impressed the early legislator as a sort of improved common road, to be ranked with the macadamized turnpike; at any rate, the first railroad charters were patterned directly upon turnpike charters.

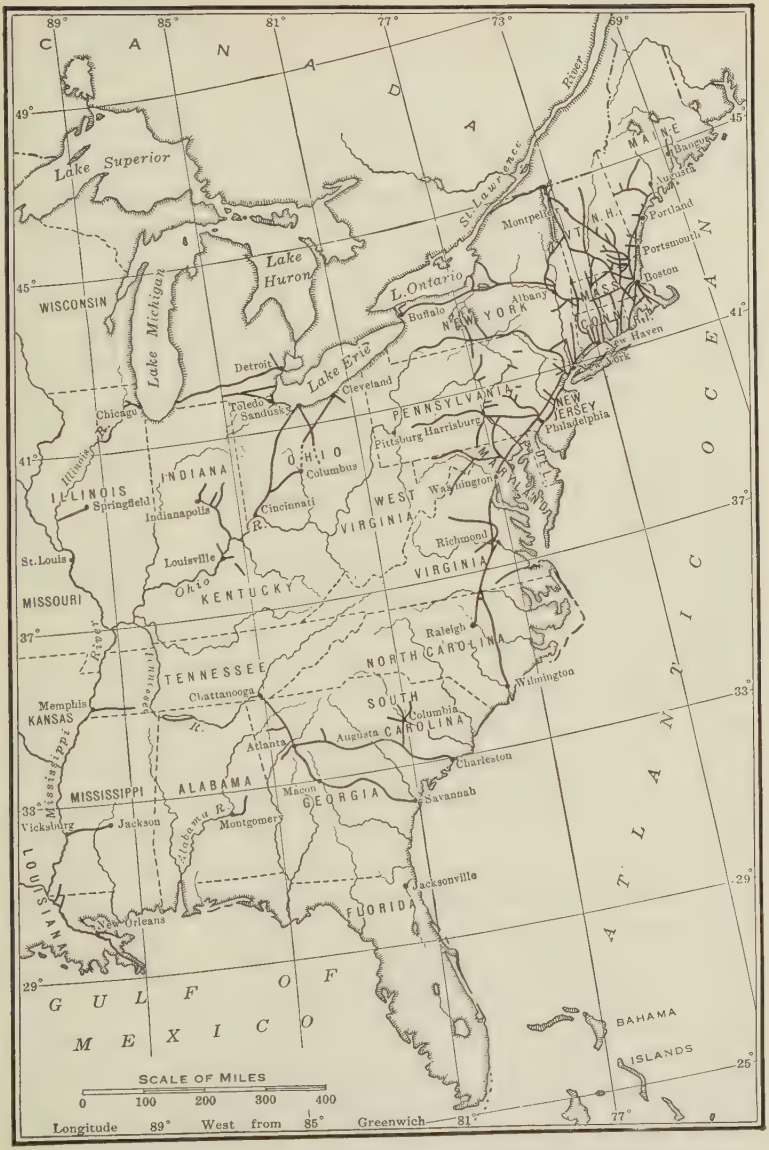


AN EARLY AMERICAN LOCOMOTIVE SHOWING SMOKESTACK; WHEN WOOD WAS USED FOR FUEL

Retardation of development. There was much opposition to the building of the first railroads on the part of rival transportation agencies, such as turnpike and canal companies and owners of stage lines. Tavern keepers were against the innovation because they thought they would lose business built up in connection with horseback and stage travel. But the growing cities were reaching out for the trade of adjacent country districts, the rapidly developing West was calling, and railroad construction proceeded, all things considered and despite difficulties, at a good speed. To realize this we must remember that there was a day of small things even in the powerful industry which we now accept as a matter of course. During the first decade of railroad-building only 2800 miles had been put into use; ten years later, in 1850, there were about 9000 miles. And during this time the railroads had to demonstrate their superiority over canals; people were slow to realize their possibilities; capital was scarce; and it was not known for some time whether or not the railroads could compete successfully with the waterways in the carrying of freight. Not until the middle of the century was it apparent that our railways were destined to carry heavy freight as well as passengers and packages.

No railway systems. All these facts made for retardation of development, and up to 1850 our railways occupied an unimportant relation to the country's internal commerce. There was as yet no idea of a railway system; the lines were local and isolated. Philadelphia, as the converging point of a number of lines, was at first the most important railway center; New York made connection with the West by the Erie Canal, which had a big traffic both in passengers and freight. From 1840 to 1850 it was in New England that railway mileage increased most rapidly.

Outreachings toward the West. Before 1850 the railroads were located almost exclusively in the states along the Atlantic; the only important line in what was then called the West was one running from Sandusky to Cincinnati. Up to 1850 the internal commerce, at least, was carried almost solely upon natural and



RAILROADS IN OPERATION IN THE UNITED STATES IN 1850

artificial waterways and upon roads. Previous to 1850 only one line of railroad had been completed between tidewater and the great interior basins of the country, and even this line was a series of links rather than a continuous chain. These links were later absorbed into the New York Central. Carriage of freight on this line was taxed by the collection of canal tolls in addition to other charges for transportation, the result being a virtual prohibition of traffic. The commerce resulting from these early roads amounted to little until the middle of the century was passed. The line next opened, from Boston to Ogdensburg, was also composed of distinct links; and the third, the New York and Erie, was not opened until 1851. The fourth was the Pennsylvania, whose mountain division was opened in 1854, after a period of the use of inclined planes with stationary engines, constructed by the state. The fifth line, the Baltimore and Ohio, was opened in 1853; and in 1859 the Memphis and Charleston railroad finally reached the Mississippi. In the extreme north the line now known as the Grand Trunk was finished in 1853. In 1858 the Virginia system connected up with the Memphis and Charleston and the Nashville and Chattanooga railroads.

Trunk lines. Upon these original lines was erected the vast system that connects our interior with the seaboard and that served as an outlet for its products, which would have had little or no commercial value apart from cheap transportation. By 1860 the railroad lines named above, assisted by the Erie Canal, afforded ample means for the speedy and cheap transportation of products seeking Eastern markets, and were entirely competent to deal with that stream of trade.

Conditions previous to the Civil War. This shows that the trunk lines were laid down between 1850 and 1860 and that the same period was experiencing the consolidation of short lines into systems. By 1853 it was possible to travel from the seaboard to Chicago by an all-rail route. In the decade after 1850 there was much activity in railroad-building in the region north of the Ohio and east of the Mississippi, supported by Federal grants, state

subsidies, and general good times — until these last were interrupted by the panic of 1857. This calamity, followed closely by the Civil War, put a check on railroad-building which was not thoroughly shaken off till 1868. Then followed five years of intense speculation in railroad securities, during which, also, the mileage of the whole country increased 40 per cent.

Transcontinental lines. Meanwhile there was an unparalleled extension toward the Far West. The discovery of gold in California and the movement of population thither awakened interest; and in order to get that section connected with the East the Federal government was liberal in its gifts to companies that would undertake the tremendous task of building railroads to the Pacific coast. There was also a feeling that the Far West could be yoked closely to the free states of the North in the struggle which was threatening between North and South. Yet the idea of a railroad from New York to the Pacific had been brought forward as early as 1834. The supposed barrenness of the West and other attendant difficulties caused this proposition to attract little attention; but Congress was finally induced, after much agitation, to grant liberal subsidies to the Union Pacific and Central Pacific railroads. Then the former built westward from the Missouri River and the latter eastward from Sacramento, which was already connected with San Francisco; and in 1869 the two lines met, forming the first transcontinental line.

Rapid progress after the war. We left the general railroad situation, in the paragraph before the last, at 1873. The panic of that year is the next factor in railroad as well as in national history. It is said to have been caused by the too rapid building of railroads and the over-investment in them as much as by any other single factor. From 1873 to 1878 our railway mileage was increased by only 11,500, so that the total mileage in 1880 was only a little over 93,000. Then, during the decade following, this mileage was nearly doubled, some 73,000 miles being constructed. Though all sections of the country had their part, the central and Western sections were most active, since they were being rapidly settled

and were making marked progress in material development. In some cases railways preceded settlements, preparing the way for the immigrant; there was much flimsy construction in places, so that, as it was said, some lines consisted only of a "right of way and two streaks of rust."

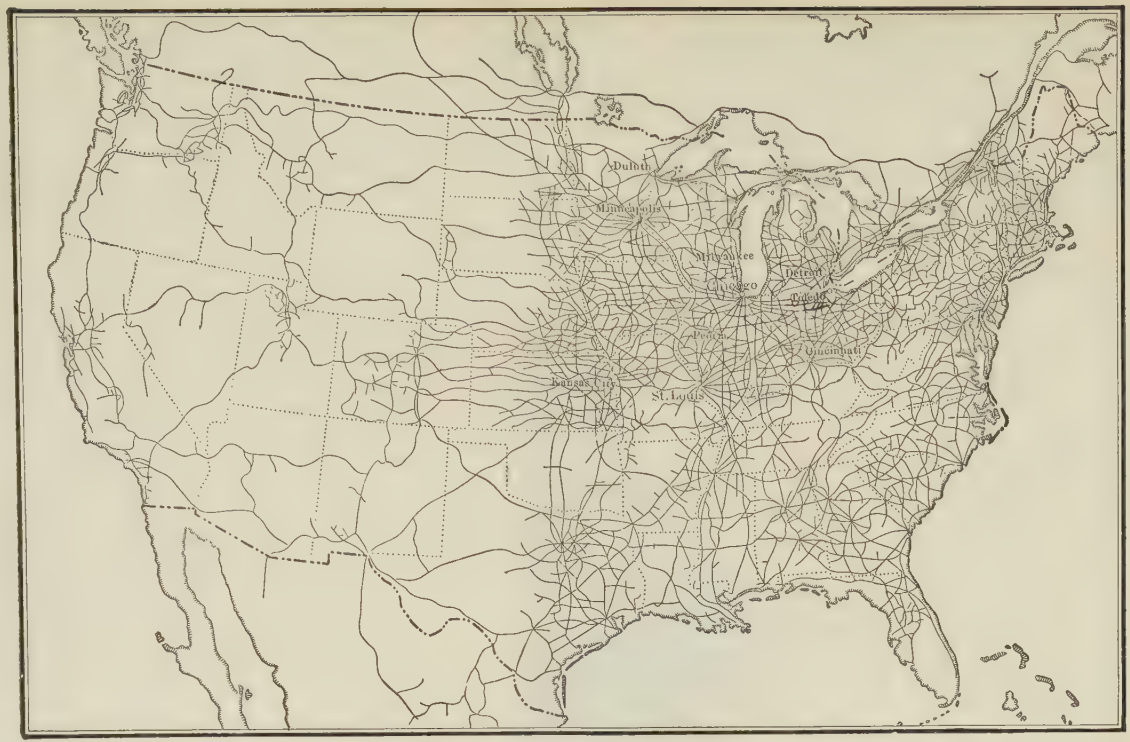
Recent construction. Since 1893 the advance has been rather deliberate, the annual mileage constructed averaging about 2000; but with the return of prosperity, in 1898, there was a gradual recovery in rate of building, several thousands of miles being added each year. The fact of it is that traffic on our railways has increased recently much faster than the mileage built. Judging from the embargoes that have to be laid by the railways and the delays that at times are borne by those who deal with freight departments, it would seem, even to the non-expert, that the business of the country is outgrowing the available railway service. This view is held by some railway specialists. Nevertheless our railway mileage is something like two fifths that of the whole world and exceeds the combined mileage of all the countries of Europe.

Increase of mileage. The following table gives a detailed outline of single-track mileage at successive dates:

Year	Mileage	Year	Mileage
1830	23	1901	198,743
1840	2818	1902	202,938
1850	9021	1903	207,335
1860	30,626	1904	212,394
1870	52,922	1905	217,341
1880	93,267	1911	246,236
1890	166,702	1914	263,547
1900	194,262	1924	262,158

At the present day, along with the single-track mileage, we have over 150,000 additional miles of second, third, and fourth track and of yard-track and sidings.

Railroad rates. As the railway net of the country has expanded, numerous improvements have appeared all along the line,



RAILROAD MAP OF THE UNITED STATES

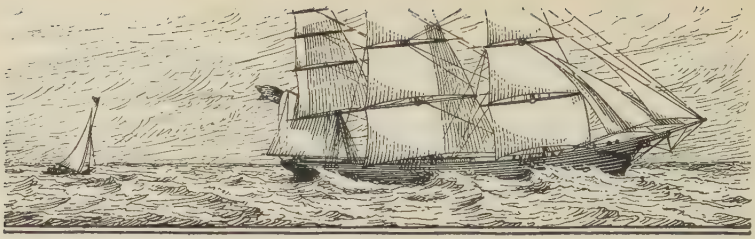
particularly in the service given the public; and together with such improvements has come a marked reduction in freight and passenger rates. In the early days of railway transportation the American public paid from four to thirteen cents per ton mile for carrying goods; in some of the early charters authority was given to charge a rate on bulky articles of ten cents a ton mile or of ten cents per cubic-foot measurement for a distance of a hundred miles. At the present time our average freight rate per ton mile is close on to ten mills, but the figure varies greatly in different parts of the country. It should be realized, though it is not generally known, that, generally speaking, a railroad depends for its revenue upon its freight service, the passenger service counting for no more than a small gain or, perhaps, even a loss.

AN ELECTRIC LOCOMOTIVE HAULING A PASSENGER CAR

Electrification. The electrification of railway lines is a growing movement of the present day; a road so equipped spares passengers many of the worst discomforts connected with travel. It is predicted that heavy passenger trains running at rather long intervals and drawn by powerful locomotives will give place to the more frequent service of trains composed of from two to four motor cars. That would mean that the railway service is going to approximate to the trolley service, with which it has, in a number of localities, come into competition and combination. It was the invention of the dynamo that made possible the utilization of electricity to drive motor cars, and, once tested out, the latter speedily displaced the horse car; 70 per cent of the street-railway mileage of this country was run by animal power in 1890, while to-day the electric car is practically universal.

Revolution wrought by the railroads. Railroads, with their numerous problems of control, capitalization, reorganization,

charges, etc., come in for a good share of this country's attention. It was in connection with transportation that the American captain of industry found fields worth conquering. It was here, perhaps, that adequate opportunity was first provided for the display of the highest business ability. Our great accomplishments in railway engineering and operation have been brought about within the lifetime of some of our oldest fellow citizens. This has meant a tremendous industrial revolution through the substitution in transportation of mechanical for muscular power. The astonishing rapidity of these improvements in transportation forms a very good measure of the pace of industrial progress not only in this country but in the world at large during the period since the invention of the steam locomotive.



CHAPTER XXVIII

NATURAL WATERWAYS AND THE MERCHANT MARINE

Importance of the minor waterways. If anyone is anxious to see the development of American industry as it really has been, he must not shut his eyes to the importance of even the smallest type of our natural waterways. For the eastern half of our country, as it developed, there was on the one side the sea and on the other the Mississippi and its great tributaries — the importance of these cannot be overlooked by anyone. But the whole country between was a network of protected tidewater bays, inlets, and small streams on the east, and, farther west, of innumerable small tributaries to the great river system. But the small streams and the upper courses of the larger ones, far above the point of steamboat navigation, were of great service in floating products of various sorts down to the navigable waters. Small boats penetrated long distances upstream and tapped many small springs of trade which without them could not have contributed to the great currents of commerce.

The traffic of the natural waterways. The canals did not diminish the importance of our natural waterways, large or small; on the contrary, they increased it. They were generally laid out for the purpose of connecting ways already provided by nature, and they increased the traffic on such ways up to the time when the railroad succeeded in rendering other forms of internal transportation, for a time at least, obsolescent. There are not many statistics to be had covering the traffic upon natural waterways,

least of all upon the smaller ones; the government did not assume control of the waterways as it did of the railways, and the water carriers were not obliged to submit to the authorities such statistical reports as those required of the railroads. Consequently, even for the period when the inland waterways did the bulk of the carrying business, there are no very complete returns of an exact nature. General considerations, which are, however, no less true for being general, are about all that we can cite for the earlier period.

The two great systems. The two great natural systems were the Mississippi and the St. Lawrence, the latter taken in connection with the Great Lakes. For over two centuries many events had conspired to increase the significance of these two water routes. They had been of great utility to the American Indians, and had then been traversed by explorers, missionaries, fur traders, soldiers, and sailors of various nations — of France, Spain, Great Britain, the Thirteen Colonies, and the United States. Then came the rapid settlement of the Western states, from Canada to the Gulf; and presently there was an enormous supply of products and demand for merchandise from distant parts, which called for channels through which extended freight transportation might take place. But there were really only these two alternative routes — in fact, most regions had no choice at all, for it was clearly indicated to them which of the two routes represented the easier and cheaper means of communication with the outside world.

Early river traffic. There was relatively little traffic on the interior waterways, especially on the Mississippi, before the day of the steamboat. The movement between the Ohio River settlements and New Orleans was abruptly interfered with in 1785, when Spain enforced commercial restrictions on the lower Mississippi; and it was well along in the last century, after the Louisiana Purchase and the War of 1812, before the obstruction and annoyance to traders were sufficiently removed to allow of steady traffic. We have already spoken of the flatboat trips down

the Mississippi. It is hard to realize the difficulties of the early river navigators, who, besides contending with the snags and shifting shoals of the Mississippi, had to maintain a constant watch against hostile savages. The settlements down river were small and the people had no great purchasing power; there was not much use stopping north of the delta. But two events came about soon after the War of 1812, which had a great influence on the development of the West, and so of river navigation. These were, first, the introduction of the steamboat upon Western waters and, second, the spread of cotton culture into the Southwest.

Factors favoring river navigation. The steamboat was introduced upon the Western interior waters in 1811, and by 1817 was becoming common upon the Mississippi and its tributaries; and now, for the first time, the Northwest was put into easy communication with the East, with the result of an immediate increase of trade. It was the introduction of cotton-raising in the Southwest that gave to the Northwestern states their first important market. These two events happened at about the same time, in the second decade of the century; and a trade between the farmers of the Northwest and the cotton planters of the Southwest, unimportant before 1815, soon grew to large proportions.

The river steamboat. With the steamboat it was possible to make trips up the river as well as down; but it was some time before the steamer was able to eliminate the cruder crafts — rafts and flatboats — from the river. A good deal of experimenting had to be done before a type of boat adapted to river traffic was evolved; it proved to be a broad, shallow craft, able to carry a thousand tons, though drawing but four feet of water. By 1826 nearly 60 per cent of all the freight brought down the river to New Orleans came by steamer, and from this time the steamboat traffic continued to increase until the outbreak of the Civil War. By it freight rates were lowered, as well as trade increased, and it continued to be important until the extension of the railways marked its downfall; at first the railways assisted it, by serving

as feeders to water lines, but this was for a brief period only. By 1860 the through Chicago-New York route was drawing traffic eastward at the expense of New Orleans.

Competition of the railroads. Until the middle of the century Mississippi Valley freight was moved chiefly by water. The railway lines were short and were interested for the most part in the passenger traffic; in so far as they carried freight at all they carried it to the nearest water line. But shortly after 1850 the railroads began their destructive competition with the water

A MISSISSIPPI RIVER STEAMBOAT

routes, and by 1860 they were endangering the river traffic. Then came the Civil War, which closed the Southern ports, and traffic toward the South ceased. But the railways continued to extend during the strife and to gain greater and greater advantages in the competition. Then, after the war, the lines running east and west were much improved, with the result of drawing the river commerce across the mountains to the East. In 1869 it was said that grain could be moved by rail from St. Louis to the North Atlantic seaboard much more cheaply than from St. Louis to New Orleans by steamboat. By 1873 the railways were carrying to market over four fifths of the grain and provisions of the West, and by 1874 they had paralleled the route from north to south by a line running along the Mississippi from Chicago to New Orleans.

Present-day river traffic. At the present time the most important features of the river traffic below St. Louis are two: local trade between villages scattered along the river, and the transfer of cotton along the lower Mississippi. There is, however, considerable traffic down the Ohio. The water traffic of the Mississippi, like that of the Erie Canal before it was modernized, was not properly organized and supplied with mechanical appliances for loading and unloading adequate to enable it to compete with the railways. The vessels were owned largely by private individuals who showed little desire to coöperate. The coal-carrying business on the Ohio has been well managed, but it is an exception.

The Great Lakes system. The Great Lakes constitute the grandest inland waterway of the country and of the world. They are connected with the Atlantic by a channel available for vessels of fourteen feet draft at its shallowest point, namely, the short artificial stretch known as the Welland Canal, between Lakes Erie and Ontario; this canal is now being deepened. The largest ocean-going vessels can come up to Quebec and Montreal, although originally the St. Lawrence was shallow at several points between these cities, so that during a large part of the season of navigation vessels drawing over ten or twelve feet could not get to the latter city. Of course the greatest handicap of the whole system is that it is usually ice-bound from the end of November to the end of April.

Improvement of the Lake system. The Canadian government has spent large sums of money in improving the St. Lawrence and in building the Welland and other canals. In 1851 they commenced to deepen the river channel and by 1882 had a depth of twenty-five feet, which has now been increased to upwards of thirty. The American government also has spent a great deal, especially on the "Soo" canal, between Lakes Superior and Huron. This improved system of waterways is of inestimable benefit to the industries of both countries; the total navigable length of the Great Lakes is one thousand four hundred and ten miles, and they are the bearers of the greatest bulk of shipping upon any body of inland water in the world.

Lake traffic. Our merchant fleet on the Great Lakes is a large one. About six sevenths of this is steam-driven. The average size of the steamers is small, but recent additions to the fleet are as large as many ocean liners. Of the Lake traffic 90 per cent is confined to four articles: iron ore, grain (including flour), lumber, and coal — the first of these forming about half of the

MODERN TRAFFIC ON THE GREAT LAKES

Note devices for loading and unloading quickly

total annual tonnage. And 90 per cent of the ore has, for its destination, ports on Lake Erie, the only important receiving point not on that lake being Chicago. Wheat is received mainly at Buffalo, lumber at Chicago, while anthracite generally starts from Buffalo, and soft coal from several Erie ports.

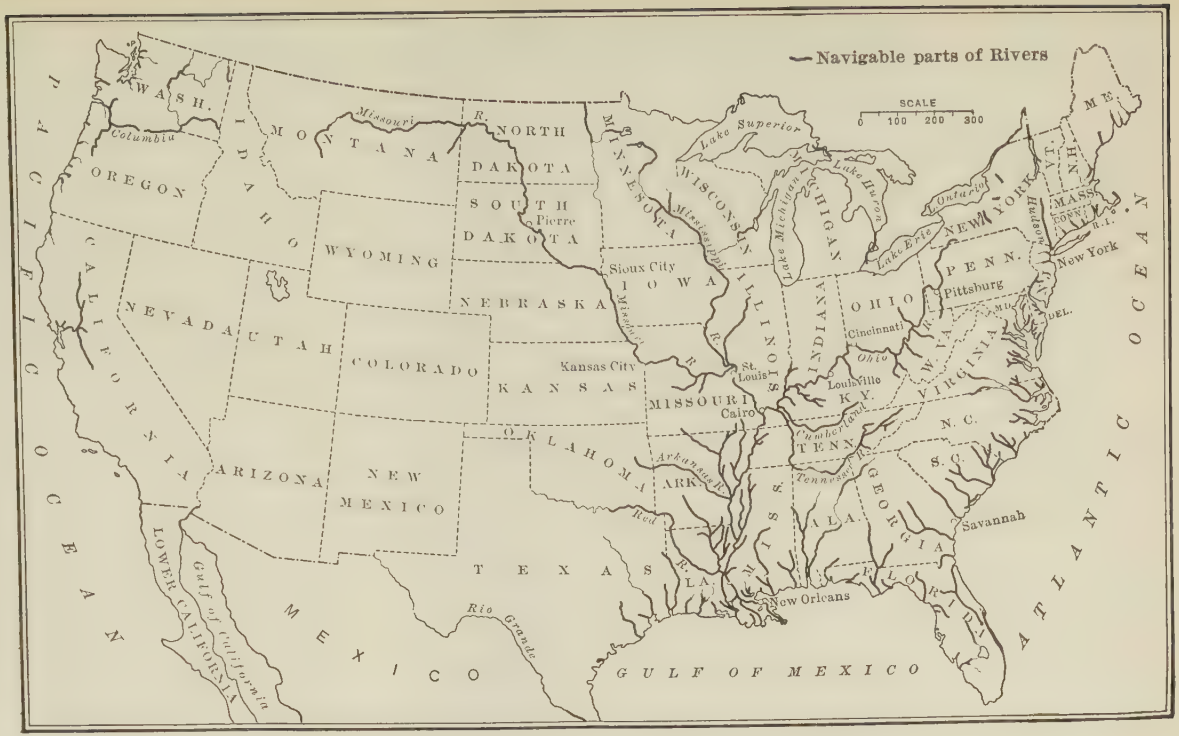
Organization of the service. The organization of the transportation service on the Great Lakes has been so perfected that the average freight charge per ton mile has been about one tenth that of the average railroad rate for the whole country. There is much saving in shipping by water. Freight shipments on the

Lakes are ordinarily over long distances, and nearly all the steamboat lines operate on two or more lakes. The eastbound tonnage far exceeds the westbound. Most traffic of the Great Lakes is raw material carried in great bulk. Time is a factor of small importance in the transportation of such material, and so it can be handled, going by water, at a rate which renders railroad competition impossible.

Extent of our inland waterways. Our wealth in inland waterways is not exhausted with the consideration of the Mississippi and Great Lakes systems. The extent of our inland waterways is unmatched in any other country, and they are so distributed as to be readily available for commerce. The Mississippi system alone furnishes 16,000 miles of waterway. In all there are 25,000 miles of river that can be navigated, and as much more that can be made navigable. Then there is a series of sounds and bays along the Atlantic coast and the Gulf which can be connected by canals to form a continuous inner route for coastwise traffic of about 2500 miles in length. Adding in the Great Lakes route, the present and planned waterways of the country would reach the figure of 55,000 miles, of which only about half is now used for navigation. There are many plans being considered for improving the waterways to supplement the railways as commerce-carriers. The movement toward improvements has taken form in a number of waterways associations, some with local aims and others with national programs. The ideal system of internal transportation is where the waterways and railways complement and coöperate with one another. This is more common in Europe than it is here.

The Merchant Marine

The salt-water fleet. The traffic of the Great Lakes is carried on by a section of our merchant marine, but it is not of the fresh-water fleet that we wish now to give an account; in what follows the merchant marine means the ships that perform their trading function on salt water.



NAVIGABLE RIVERS OF THE UNITED STATES

The colonists were seafarers. A large proportion of the settlers in the earliest colonies were familiar with the sea, and the conditions of life here were such as not by any means to wean them away from it. It is not strange that the sea and shipping so thoroughly monopolized the attention of the settlers, and that the coast was dotted with shipyards before the interior had been penetrated to any great extent. The building of vessels is among

AN EIGHTEENTH-CENTURY MODEL

the oldest colonial industries. They were very small at first; in 1641 a ship of three hundred tons was built at Salem, which was pronounced "prodigious," — in fact, as late as the beginning of the nineteenth century a three-hundred-ton vessel was regarded as a large one. New England, New Amsterdam, and other colonies were active in building vessels. Types of boats improved as time went on, and the settlers extended their trade to the West Indies, finding there a ready market for colonial staples — dried fish, lumber, and rum — and a return cargo of sugar and molasses. This trade was very dangerous, for the coasts were neither charted nor lighted, and pirates infested the West Indies.

Colonial shipbuilding. There was constant encouragement lent to the shipbuilding industry; ship carpenters were urged to come to the country, and as early as 1639 there was for them, in New England, exemption from compulsory military service. The early merchant vessels had no navy to protect them, but went out prepared to protect themselves. A merchant seaman of that time not only had to know all there was to be known about handling a ship but he must also be an expert in the use of cannon, musket, cutlass, and other weapons of the time. In pursuance of their trade these shipbuilders and seamen, early in the eighteenth century, arrived at the schooner design. The name is said to have come from the verb "to scoon," meaning to skip over the water in the manner of a flat stone, and was applied under the following circumstances: when the first schooner, built at Gloucester, was being launched, an enthusiastic spectator is said to have exclaimed, in admiration, "See how she scoons!" This type of boat speedily proved itself well adapted to the demands of the time; it was superior to the square-rigger with two or three masts and required fewer hands to operate it. At the close of the colonial period, in 1769, this model was making its way at the expense of the older ones; for in the year mentioned there were constructed in the colonies 113 square-rigged vessels as against 276 sloops and schooners. The total tonnage was 20,000 tons, as we have elsewhere mentioned, showing an average of 50 tons per vessel.

Expansion of the merchant marine. On December 31, 1789, our merchant fleet amounted to some 200,000 tons, of which 124,000 were registered for the foreign trade; a little over 68,000 tons were enrolled for the coasting trade, and the rest were engaged in fisheries. The wars in Europe during the last years of the eighteenth century and up to 1815 gave the neutral American merchants their opportunity; they became the principal carriers between the fighting nations and their colonies. "While the great commercial nations were fighting one another for the carrying trade of the world, America ran away with the bone

over which they were quarreling." There was a big expansion of American commerce and shipping after 1789, the tonnage of the foreign trade fleet rising from 124,000 in that year to 744,000 in 1805 — an increase which, measured in percentage, is probably unparalleled for such a length of time. Then came the hindrances to trade connected with the Embargo and other events incident to a troubled period in our international relations, and the figure for our tonnage had increased by 1815 only to 854,000.

AN AMERICAN CLIPPER SHIP

The American ship. At this time the commercial relations with Europe were regular enough to warrant schedules of sailing; the first packet line, so called because it carried the mail packets, was started in 1815. This and other such lines were operated with success and gave this country a position in the ocean carrying trade that was altogether enviable. The American clipper ships were famous in their day (the name coming from the sharp lines and long overhanging bow characteristic of them) and represented an effort on the part of American builders to bring out a fast-sailing ship to compete with the British steamers. The first is said to have been built in Baltimore in 1845, about five years

after the steamer had been introduced, and when it was threatening to rob the American sailing vessels of both passenger and freight business.

The golden age of American shipping. The golden era of the American sailing vessel was the decade preceding 1860. During that time the building and operating of such vessels was attended with great gain. The oversea commerce was carried mainly by sail, and there was a large passenger and freight traffic between our Eastern and Western seaports which called for numbers of sailing vessels. Even after the California gold fever began to abate, there was still the demand created by the Crimean War, for both France and the United Kingdom purchased large numbers of American ships for use as transports. In 1855 over 980,000 gross tons were launched in American yards, this representing the highest mark of ship construction for any year of the nineteenth century.

Decline of the merchant marine. The decline in tonnage connected with foreign trade has been rather marked since the Civil War; in 1861 the fleet thus engaged amounted to almost 2,500,000 tons, a figure never attained before. Among the causes for decline are mentioned withdrawal of subsidies, burdens on the yards from internal-revenue taxation and high tariffs, and the extraordinary development of industry, coupled with the opening up of the West, which drew attention away. The complete and satisfactory explanation of this decline is a hard matter. The Great War caused a marked revival in shipbuilding, entirely aside from the war policy of the government which called for many vessels; it was the prospect of extraordinary profit that gave the first stimulus. The figure for the tonnage of registered ships was, in 1912, something over 900,000; by 1913 it exceeded 1,000,000; and in 1925 it totaled 8,151,000, of which only 614,000 tons were under sail. It was after the Civil War that the steamer began to supersede the sailing ship in our merchant marine; but it has not altogether driven out the older type and probably will not. In fact, in the case of freight that can take

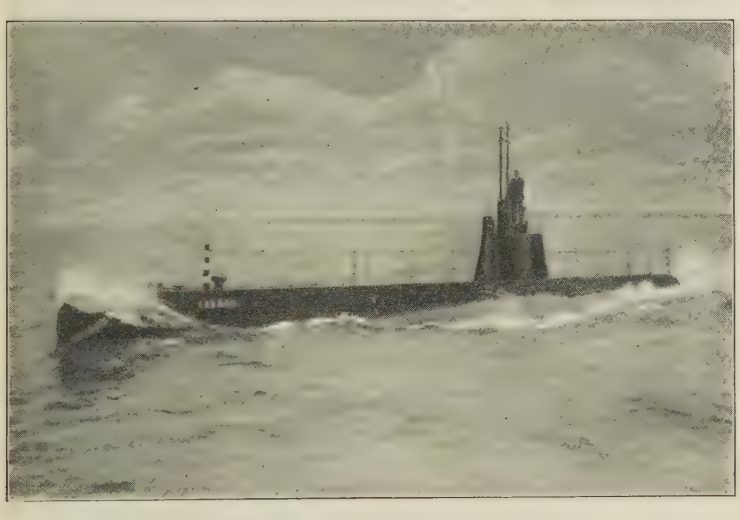
its time, a return to wind power may easily occur, especially if it remains needful to economize on coal.

The steel ship. Another change that the modern age has seen has been that from wooden ships to steel ships. Until 1840 or later wood was the universal construction material; then about the middle of the century Great Britain began to use iron

AN OCEAN LINER IN NEW YORK HARBOR

extensively, building but few wooden vessels after 1850. At this period we had cheap wood and expensive iron, and so stuck to the old material until about 1870, while by 1880 the British were ready to advance yet farther, from iron to steel. The result of our backwardness has been that we became dependent upon the rest of the world, and especially upon Great Britain, for the carrying of our commerce. During the last half century there were such tempting opportunities for capital and labor in land-development that they were less attracted to the water.

Terminals. Because of the tremendous expense involved in providing terminals for much larger craft, it seems that the size of vessels, especially ocean liners, has reached, or is approaching, a limit. Docks and piers are already strained in their capacities for taking care of our biggest ships, and until there shall be some epoch-making improvements in terminals the increase in size of vessels must necessarily proceed at a slow pace.



A SUBMARINE — THE HOLLAND TYPE

The coastwise fleet. We shall conclude with brief allusion to our coastwise traffic. Only American vessels may engage in this, a regulation which sets it under conditions quite different from those of foreign commerce. Thus the growth of the coastwise fleet has been automatic; unless trade was to be hampered, the coastwise fleet had to keep pace with the economic expansion of the country. At present our enrolled vessels, which include not only those engaged in coastwise trade but also those upon inland waterways (which must likewise meet the needs of our expanding economic life), total well over 9,000,000 tons — this figure not including ships of less than 20 tons.

Shipping as an investment. It is plain enough that the destiny of our merchant marine is closely linked up with the question as to where we can put our money to best advantage. If profitable

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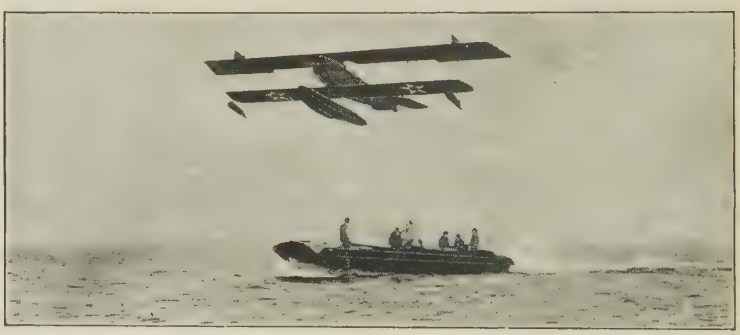
A HYDROAËROPLANE OF THE UNITED STATES NAVY JUST ABOUT TO LEAVE THE WATER



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WELL AWAY AND HEADED FOR THE CLOUDS

opportunities come in shipping, and capital is allowed to make use of them without unreasonable restriction, its flow will set in automatically toward the marine just as it automatically withdrew from it when conditions became unfavorable as compared with those existing in other enterprises.

CHAPTER XXIX

THE INFLUENCE OF TRANSPORTATION UPON AMERICAN INDUSTRIAL DEVELOPMENT

Trade and industrial development. From what has been said in preceding chapters it is clear enough that the industrial progress of any country depends very largely upon the degree of perfection attained by the transportation system. For trade, on anything but the most meager scale, is impossible without transportation; and without trade there is no opportunity for industry on the large scale, where many men must spend all their time making a single product. This last is something which they could not do unless there were other groups of men, perhaps at some considerable distance, who were ready to supply them with the various articles which they need.

Trade and civilization. In fact, we can go farther than this and say that without the development of trade on a rather large scale civilization itself would scarcely be possible. Trade has been called "the handmaid of civilization," but it is rather its forerunner and way-preparer. No other agent in human history has been so powerful in spreading civilization as has the trader. Led by the desire for profits, he has made his way to the remotest corners of the earth and has always carried with him the products of civilization: tools, inventions, foods, textiles; and arts, letters, and other less material things as well. From him the more backward peoples have learned first the products and then the processes of a more advanced culture; and when trade relations have been

steady and frequent enough, the more backward race has usually been raised toward the higher plane of life.

Transportation and American industry. The advance of any country in material prosperity is dependent, in large degree, upon the transportation facilities available. These are so necessary that they are often overlooked, for, like the presence of the atmosphere, they are taken to be a matter of course. People get their eyes upon the stream of trade and seem to regard that as the fundamental factor in prosperity, not realizing to the full that all the articles of trade have to be carried by some agency. This is true in the history of our own country. It is not going too far to assert that there is no single influence which has played a more essential part in American industry than transportation.

How our history centers about transportation. During the colonial period, when we depended chiefly upon foreign commerce, we were compelled to use marine transportation. This continued well into the nineteenth century, when the shipping and carrying trade still ranked in importance with the growing manufactures. Later, when we had developed a great internal commerce, our chief interest was a national system of transportation. Then we devoted the greater part of our accumulations of capital and much of our keenest business ability to the development of what were called internal improvements — mostly transportation projects. In connection with these there first appeared those characteristic figures of American society, the millionaire and the captain of industry; and here, too, there developed, more rapidly than anywhere else, the great business corporation. We have not always realized the importance of this development of internal improvements, but have given more attention to the growth of manufactures, to currency and banking systems, and to other such enterprises; but no one of these matters has come anywhere near exerting the influence upon our economic growth that has been wielded by improvements in transportation. In fact, since 1815 our most conspicuous industrial achievements have depended directly upon this factor.

How America captured the cotton market. To illustrate, let us take that early American triumph, the almost complete monopoly of the world's cotton market. We have seen in a foregoing chapter that we possess a climate and soil peculiarly adapted to cotton production; but these alone would not have secured the monopoly of the market. It required the network of navigable streams which cover the whole Southwest. But even their presence was not by itself enough; it was the invention of the steamboat, which suddenly converted them into a first-class transportation system, that insured success. Similarly, it was not alone the possession of natural grainfields that gave us first place in the international trade in breadstuffs; it was the ease with which railroads could be constructed in those regions, combined with our improvements in rolling stock, that enabled us to avail ourselves of our natural advantages. In general, we have in this country a remarkable territorial division of labor, which is the basis of our internal commerce. No other country shows anything like it. Through it we have been able to reach that great development of rich natural resources along all lines which has formed the basis of our prosperity. But this also is largely the result of easy and cheap transportation, which has smoothed the way for a copious internal commerce.

Transportation is vital. It is sometimes easier to realize the importance of that to which we are commonly accustomed if we try to imagine it utterly absent. Let the reader pick out any industry he likes and try to imagine it in operation in the absence of existing transportation facilities, and he will quickly realize how all modern industry rests upon modern transportation development.

Transportation increases property values. There is another way in which the transportation system affects industrial and social life, namely, through the increase of property values. Railroads in this country have exerted a powerful influence along this line — much more powerful than in some other countries. In every part of England are to be found large cities which take over the products of the surrounding country, consuming them not far from

the spot where they are raised. It has been said that every British farmer lives within sight of a market. The same is true of manufactures; distances are short there and the railroads have had no such effect in developing a section as in the United States. But in this country, where distances are tremendous, what the farmer needs most is not a fertile soil — for he has that — but rather a market; and that can be supplied to him only through the agency of transportation. Thus the railroads increase immensely the value of property. It was estimated, in the middle of the nineteenth century, that the increased value of a belt of land ten miles wide lying on either side of a certain railroad was equal to at least $7.50 per acre. This amounted to $96,000 for every mile of road, though the road itself cost only about $20,000 per mile. Thus the railroad created a value in real property alone equal to about five times its cost.

It allows of city growth. The railroads have likewise increased property values at a considerable distance from their lines. For the development of a transportation system is what allows of the growth of great cities; and the land values in a city rise with its growth. If the transportation system were to be permanently paralyzed, population would have to disperse from the great centers, and the land values in these centers would decline, in many cases to zero. In Massachusetts the valuation rose 100 per cent between 1840 and 1850, and by far the greatest part of this was due to railroad construction.

Transportation and political unification. It is worth while to mention the fact that the transportation system has political bearings. Easy communication between different parts of our country tends to strengthen and perpetuate the Union, for nothing is more likely to create sympathy between human beings than frequency of seeing and communicating with one another. One of the reasons for putting through the first railroad to the Pacific coast was, as we have seen, that California might be linked in sympathy with the free states of the North. The railroads are also of great military advantage to a nation when it is at war with foreign

powers. The excellent roads radiating from Paris are said to have saved that city from the German invaders in the first few days of the Great War. A large army was rushed by automobile from Paris to the Marne within a few hours. It can thus be seen that modern states, if they wish to secure the highest stability, must follow the example of the ancient Romans, who always knit their empire together with the best of roads. But the stability of a government is of very great importance to the welfare of its industrial life. No industrial activity of importance can prosper under a weak and tottering political system. If, therefore, the development of a transportation system, and particularly of railroads, is of advantage to the national government, it must thereby in yet another way than those mentioned in the preceding paragraphs be of advantage to a national industrial life.

Cheap carriage. One of the marks of an effective transportation system is, of course, cheapness of carriage. An author of repute states that you could not construct a railroad twenty miles long without enabling farmers to send their products to town at from one half to one fourth of what it had cost them previously. This lowering of rates has enabled farmers to sell vast quantities of products which before that could not pay the cost of transportation. Illustrations are numerous: in Maryland freights and tolls amounting to several dollars a ton were reduced by road-building to one cent a ton; in South Carolina a railroad to the interior transported cotton to the seaboard for a few cents a bale, where it had previously cost three or four dollars to get it down by the rough and swampy wagon roads.

Costs before railways. In 1832 the writer of an article advocating the construction of the Erie Railroad declared:

> It would prevent a recurrence of the state of things which now exists in the city of New York. There would not then be, as there now are, thousands of barrels of flour and other kind of produce in proportion, frozen up in canals and in sloops on the Hudson; salt would not now be selling in Albany for $2.50 per bushel and pork at $2 per hundred for want of salt to save it, while pork is worth from $5 to $7 in this city. Coal would not then sell here for

$15 or $16 per ton; nor oak wood at $9, and hickory at $13 per cord, as has been the case for two or three weeks past, if railroads were in general use; but all kinds of business would move on regularly and be more equally divided throughout the year. Produce could come to market as well in January as in July; and the farmer would not be obliged, in order to get his crop to market in the fall, to neglect preparing for the next.

The blessings of cheap transportation. At the middle of the nineteenth century people were just beginning to experience the advantages of cheaper transportation, and it is of interest to quote what men then thought of the change. Says one of these writers:

It is well known that upon the ordinary highways the economical limit to transportation is confined within a comparatively few miles, depending, of course, upon the kind of freight and the character of the roads. Upon the average of such ways the cost of transportation is not far from 15 cents per ton per mile, which may be considered a sufficiently correct estimate for the whole country. Estimating at the same time the value of wheat at $1.50 per bushel and corn at 75 cents, and that 33 bushels of each are equivalent to a ton, the value of the former would be equal to its cost of transportation for 330 miles, and the latter 165 miles. At these respective distances from market neither of the above articles would have any commercial value, with only a common earth road to market. But we find that we can move property upon railroads at the rate of $1\frac{1}{2}$ cents per ton per mile [the 1917 rate is between seven and eight mills per ton mile], or for $\frac{1}{10}$ the cost upon the earth road. These works, therefore, extend the economic limit of the cost of transportation of the above articles to 3300 and 1650 miles respectively.

Twentieth-century rates. If this was the case more than half a century ago, it can be imagined that the twentieth century would show still more startling figures. A few of these may be cited as typical of the first decade of this century. Eggs were then brought to New York from the West, over two thousand miles, for two and one half cents a dozen; butter from the Mississippi Valley to New York City for about one cent a pound; turkeys into New York from Texas, in the winter, for about one dollar and a half per one hundred pounds. A three-pound can of tomatoes coming to New York from Maryland paid the railroad five mills; and dressed meat was brought from Chicago to New York for about the same figure per pound. A sack of flour weighing fifty pounds

was sent from the Indiana mill to almost any Eastern point for about eight or nine cents. Similarly with clothing: the transportation charge on the material used in making a pair of shoes in a St. Louis factory averaged a cent and a quarter, while the charge required to carry a pair of shoes to a buyer in any part of the United States averaged between two and three cents. The freight charge paid on the entire clothing of a fully dressed man or woman almost anywhere in the United States east of the Mississippi was somewhere between six and eighteen cents.

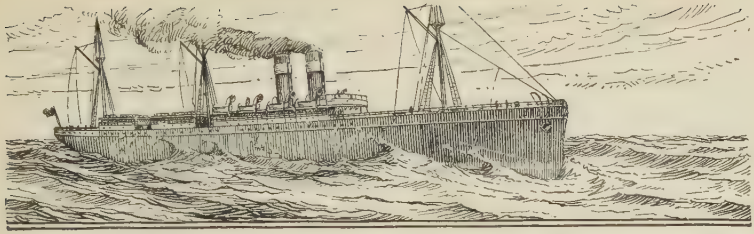
Big systems give low rates. On the whole, it may be said that the freight rates on raw material are now so adjusted that it is possible to manufacture almost any staple article at any logical place within the country. Freight rates in the United States have for decades been remarkably low — a condition made possible by the magnitude of the scale upon which our transportation is conducted. Soon after the United States was drawn into the Great War, however, there was a marked advance in freight rates as well as passenger rates throughout the whole country.

Rates of canal transportation. It would be possible to give figures illustrating the cheapness of transportation brought about by the development of turnpikes and canals. For one instance, in 1807 the cost of transportation between Buffalo and New York was $100 per ton, and the time required was twenty days; this meant that the cost of transportation between these cities was three times the market value of wheat, six times that of corn, and twice that of oats. Thus most articles were entirely shut out of any extended market. The opening of the Erie Canal, eighteen years later, of course did for commerce in a smaller degree what the railroads later accomplished on a grand scale. The cost of freight between Buffalo and New York fell to between $15 and $25 a ton and the time of transit was reduced to eight days. Rates were steadily lowered by the use of the Canal until they were reduced to about one tenth of the former figures.

Communications. Transportation and communication are very closely allied, and the development of the latter allows a speeding-up

of the machinery of business which adds much to industrial efficiency. Under the improvement of communications come the development of such factors as the telegraph, telephone, cable, postal service, postal money service, and wireless telegraphy. The invention of duplex telegraphy greatly reduced the cost of messages; then, by 1880, the telephone was in rather common use, although its invention had taken place only a few years before. The recent development of wireless telegraphy has made it possible for an exporting firm to remain in constant control of its goods while in transport across the ocean, and has otherwise enlarged the possibilities of business organization.

Good transportation a condition of national well-being. It would be possible to fill a large volume with facts and figures illustrating the subject of this chapter, but perhaps we have cited enough cases to stimulate reflection. It is true, of course, that transportation is not so fundamental to industrial development as is agriculture. There must be, first of all, something to transport. But just as soon as industry has developed beyond the first and simplest stages, it calls for transportation as a necessity for further growth. Then the transportation system becomes, to a more developed industry, fully as vital as are its supplies of raw material — in fact, as we have seen, the very value of the raw materials is dependent upon the possibility of moving them from one place to another. In its most developed form modern industry could spare the transportation system about as well as it could forego its raw materials. As we conclude this chapter, therefore, we see the truth of the statement which may have seemed to us somewhat exaggerated at the outset of the chapter, that "there is no single influence which has played a more essential part in American industry than transportation."



PART VII. THE PROMOTION OF AMERICAN INDUSTRIES

CHAPTER XXX

INTERNATIONAL COMPETITION FOR INDUSTRIAL AND COMMERCIAL SUPREMACY

Summary of preceding sections. In the preceding parts of this book our attention has been turned to the basic factors of American industrial development, namely, our natural productive areas and greatly diversified natural resources, and the qualities of the men who have been present to utilize what nature provided. Then we have followed out the development of the leading industries created by our people and the wide-flung transportation system which has been called into being for the support and service of our industries.

The stimulation of industrial life. We have said something in the preceding chapter about the importance of the transportation system, but as yet we have not made a business of describing the general policy adopted by the nation for the promotion or stimulation of its industrial life. However, it is clear enough to anyone who has kept his eyes open that there is such a thing as promoting, by the use of political, financial, and educational means, the chances of success of any particular industry or of all industries taken as a whole. In this, the last section of our book, we shall attempt to outline some of the most important

ways in which our industries and commerce have been helped along and stimulated. In so doing we shall be dealing with the present rather than the past, for until recent years no great amount of organized effort, directed along various lines to a common end, has been put forth in the promotion of our industries. In fact, we shall be dealing rather with enterprises whose outcome is not yet thoroughly known than with past events whose history is closed — with that which we can do in the future rather than with that which we have done in the past.

Earlier trade rivalries. All development, industrial or other, has always implied a struggle between competitors. If we controlled all the markets of the world, and there was nobody standing by ready to take advantage of us, we should have very little incitement to improve our system. As a matter of fact no nation has ever attained superiority, let alone supremacy, in industry and commerce without the hardest kind of a struggle. In their small way the ancient nations struggled just as hard as the modern ones for whatever advantages they aimed at or attained. The first great scene of conflict for western nations was on and about the Mediterranean Sea. This is the period of commerce which is sometimes called the Mediterranean, because the market for the control of which the various competitors struggled depended upon commercial supremacy over the Mediterranean Sea. Until the Discoveries Period of the early sixteenth century that which corresponded to the present world market was relatively small, but after discovery and colonization had begun, there came into being a real world-wide market and a rivalry for the first place in producing goods for that market.

Rivalry for the world market. The first rivals in the world market were Portugal and Spain, but their competition was commercial rather than industrial; they did not attempt to produce goods for the world market, but were largely engrossed in exploiting their colonies and in the spice trade. In the seventeenth century the competition was between Holland, France, and England, but even then this competition was mainly along commercial rather

than industrial lines. That is, there did not exist in each of the competing countries a body of domestic industries which threw its output into the world market in competition with the products of the other nations, but there was simply trade in commodities irrespective of their origin. However, such a body of industries gradually developed, especially in England, which emerged from the struggle holding first place. Her grip upon this supremacy was so strong that during the latter part of the eighteenth century, and until well along into the nineteenth, she stood without any serious rivals in industry, especially manufacturing and mining, and remained in command of the world's markets.

The strength of Great Britain. It is instructive to note the causes of this supremacy, for the study of England's case throws considerable light upon our own opportunities and destiny along these lines. Briefly, the great economic strength and commercial development of the British Isles is largely a matter of favorable geographical environment and of a marked capacity for adjustment shown by an industrious and intelligent population. Climate and other elements of the environment combined to stimulate a development of industries; the location of the islands, the fact that they were islands and were thus separated from the rest of Europe, though in proximity to it, and the broken nature of the coast line which formed many and adequate harbors — a multitude of such factors favored the struggle for industrial and commercial supremacy. Then the character of the people, combining as it did much of common sense and practical insight with independence and other solid qualities of disposition, was supplemented by the superiority of certain individual Englishmen in the matter of mechanical invention. These inventions were such as to revolutionize industry, place it upon a modern basis, and thus give to Great Britain the impetus of an early start along lines of development that were to characterize the modern world. We do not need to go into great detail concerning the industrial virtues and successes of the British, for they are commonly known.

The challenge of Germany and of the United States. In the light of history, however, the country which holds first place in industry and commerce is always likely to be challenged; and the supremacy of Great Britain came to be challenged by two other nations. She still remained the "commercial heart" of the world, but she encountered two real competitors, Germany and the United States, which came very much into the foreground before 1914. At the time preceding the Great War both of these nations were going through an industrial and commercial expansion through which Great Britain had earlier passed. The evidence for this statement is to be found in the statistics of German and American industry and trade in the decades preceding the war.

The chief rivals. Of the $40,000,000,000 worth of goods exchanged annually, in normal times, in foreign trade, about one half can be credited to five countries: the United Kingdom, Germany, the United States, France, and Holland. But the real struggle was between the first three of these nations; and the industrial and commercial strength of the foremost rivals becomes apparent when it is realized that the foreign commerce of any one of them, just before the outbreak of the Great War, was larger than that of the whole world sixty years before. Each of the three had been exerting itself to expand its industries and commerce, and lesser rivals had been putting forth similar efforts. In contrast with the rather disjointed and hit-or-miss methods of former centuries, the most modern times have shown all of the industrial and commercial countries of the world taking deliberate steps toward placing their industries upon a scientific basis and toward so organizing their domestic and foreign trade that they might resist the industrial and commercial attacks of rivals. It is of this topic of scientific organization of industry and commerce, to which nations have been incited by the stress of competition in the world market, that we wish to give a more detailed account.

Scientific organization of industry. Science as applied to industry means, for one thing, that industrial plants shall be located where they are best adapted to environmental conditions; that is,

where they can profit by the easiest methods and practice the greatest economies. Agriculture, for example, must be so organized that the various crops are grown where conditions are most favorable. This demands a sort of territorial division of labor by which is attained the most scientific utilization of natural resources. To take a simple illustration: if the cattle rangers, through ignorance or otherwise, stubbornly insisted that their ranges must be in Minnesota or the Dakotas, rather than in those regions which science has demonstrated to be the best adapted for cattle-raising, not only would the cattle industry suffer but a serious check would be given to the raising of wheat, for which Minnesota and the Dakotas are especially well adapted. Of course an industry naturally tends to settle in a region favorable to its development, and this seems to take place without very much conscious study or planning on the part of anybody. But the way in which an industry has become thus located is by repeated trial and failure on the part of persons whose knowledge was not very extensive; there has been failure after failure, which we do not hear about, in finally reaching success.

The need of special knowledge. It is clear enough that most of these failures could have been avoided if there had been sufficient knowledge available concerning the conditions of an industry so that it could have been rightly located the first time. Well, this is what science proposes to do—so thoroughly to investigate the conditions surrounding each industry that there may not be a loss of time and effort in finding out by sad experience. It is a question of using foresight instead of hindsight.

The margin of superiority. In the modern world the cost of trial and failure is much higher than it used to be. There are so many competitors in the field that often a small margin of superiority is what determines the question of success or nonsuccess. It takes only a slight superiority to win and only a slight inferiority to lose. The whole situation is like that of a foot race: if there are only a few competitors the victor is likely to win easily and by a good margin; but if there are thousands entered

in the race, there will be many bunched at the finish and the victor will be likely to win by a very slight margin. Now the application of study and science to industry has been necessary in order to secure that margin over near competitors. All the conditions surrounding a business are carefully figured out — the location, physical situation, nearness to raw material, nearness to markets, availability of labor supply, and so on indefinitely.

Expert management. In addition, the matter of management has been reduced to a science, and there are experts who instruct the owners of industries in methods of accounting and other scientific devices whose application has appeared only in the most recent years. Scientific study of the industrial situation leads also to the decision not to carry on certain industries to which the country or locality in question is not well adapted. The establishment of certain industries within a country, if the costs of production in that country are heavier than those in competing countries, is a bad business proposition; yet, in the days before the study of these matters had become a science, countries attempted over and over again to develop industries to which they were thus unfitted. If, on the other hand, the various countries apply themselves to industries to which they are fitted, and then trade freely with other countries adapted to the production of other articles, the whole group of producers is thereby benefited, for each is securing the highest profit from its efforts. Taking the great industrial countries of the world into consideration, there is in the twentieth century a much better adaptation of industry to conditions than existed a few decades ago, together with a much wider prevalence of scientific management than at any other period of the world's history.

Government action — British. In later years it has also become the common mode for the government to oversee all the industries of a country and try to render them encouragement and support by the diffusion of scientific information and advice, and even by direct control. The English business man of a former age was largely unaided by his government, and the English

method of trading abroad has been described as "every man for himself." But in more recent times, fearing the organized competition of Germany and America, the English government has come in various ways to the rescue. The consular service, the Board of Trade (notably through its Intelligence Bureau), the wider British Trade Commission, the British Imperial Council of Commerce — all these agencies, whose functions we cannot describe here, are engaged in investigating the industrial and commercial questions and conditions, at home and throughout the world, which must be scientifically solved or met in order to retain the supremacy of the past.

Government action — German. The Germans have been almost the opposite of the British, for their system has been typically paternal; the promotion of foreign commerce has been carried on in a thoroughly practical and systematic manner, but always with close coöperation between the government and the business interests. There has been an Imperial Department of Commerce and an Imperial Consultative Board for the Elaboration of Commercial Measures; the German consulates have generally been occupied by experts of various kinds, including commercial, forestry, and agricultural experts; immense amounts of literature, containing carefully collected and sifted information, have been widely distributed to those engaged in foreign commerce; railroad rates have been manipulated to favor the export trade; the banking system has been adapted to the same end — in fact, Germany has applied to commercial competition all the science she had. These facts concerning the British and German methods give us some idea of the prowess of our rivals for the world's trade.

Growth of American interest in foreign commerce. In this country but little attention was given until recently to the development of foreign commerce. Our tremendous home market, right before our eyes, shut out the view of the foreign market. But of late our industries have somewhat outgrown the former, and we have been forced to look abroad and to enter the lists as competitors for the world's trade. Within the last half century, as

preceding chapters have shown, our industries have exhibited an enormous growth and our foreign trade has increased to large size. Likewise this trade has shown a notable change. Formerly our leading exports, for which there was a ready market in Europe, were agricultural and other raw products, notably cereals and cotton. Here we had very little competition. But at present our exports of manufactures have come to form about half of our total exports, as against one fifth twenty-five years ago; and in disposing of these abroad the American merchant has met the keen competition of Europeans, who were seasoned traders long before we entered the world's market at all.

Government action — American. This new situation has forced us to organize our trade along modern scientific lines. Among other things we have reformed the consular service — a service which is a well-recognized factor in trade extension. There was a time when the consul was not thought of as a commercial helper, but now he devotes much of his effort to smoothing the way for American salesmen by minimizing prejudices and maintaining cordial relations between American and other nationalities. Daily reports are issued by the government which contain all sorts of information valuable to the trader. When our business men realized the great advantages derived by other nations from their consular service, and became aware that the American service contained many poor and inefficient consuls and so was not in good standing, they clamored for its reform, and finally got it in 1906. The system, which had been "in politics," was removed from that predicament, and the quality of the consuls was much improved. Entrance to the service was made through a rigid examination, many of the subjects of which bear directly upon commerce and practical business. The merit system for promotion was put into effect, so that we now have a reputable consular service capable of rendering powerful aid in securing foreign trade. The Department of Commerce has been separated from the Department of Labor and includes an effective Bureau of Foreign and Domestic Commerce.

Business men's organizations. Within recent years, also, numerous business men's organizations, both local and national, have been working on the enlargement of our markets; it is realized that there are many problems of policy that are worthy of united effort. The National Association of Manufacturers, organized in 1895, has built up a foreign department which covers practically all aspects of the export business. A younger body, with somewhat the same purposes, is the American Manufacturers' Export Association; and another important trade-promoter is the Foreign Trade Bureau of the Philadelphia Commercial Museum.

The national Chamber of Commerce. The Chamber of Commerce of the United States of America came into existence in 1912. It is not a government organization, but was created to serve as a connecting link between the Federal government and the American business world. Its three important functions are (1) that it acts as a national clearing house for business opinion and business methods; (2) that it furnishes close relationship between the public and the national government; (3) that it tests the business sentiment of the country from time to time by a referendum vote. Through this referendum it is able to take the pulse of the American business world when commercial or business legislation is pending, so that Congress may be enlightened as to the appropriateness of the legislation.

The need of efficiency. These are illustrations of what is meant by the scientific promotion of industry and trade. They are, of course, only the most important of many enterprises launched with that end in view. As the world grows older and there are more people who must live from its resources, it is necessary that more and more knowledge shall be gathered and disseminated, so that the most successful methods may be employed. Once producers and exchangers managed to get on with rule-of-thumb methods derived from a process of trial and failure, but now the question of living has become so much more pressing and complicated that it will not do to be content with anything less than the most thorough knowledge and efficiency.

CHAPTER XXXI

MARKETING

The feeling that "industry" means "production." When we speak of American industries we almost always have in mind productive industries such as we have been studying in former chapters of this book. We even feel that transportation is not really an industry until we realize what an enormous amount of capital is invested in transportation systems and to what multitudes of human beings these give employment. There is good reason for this feeling that the word "industry" is always to be connected with production. Let us look into this matter first of all.

Attention has been centered on production. Throughout most of the earlier history of the race the attention of people has been centered upon the production of goods rather than upon any other activity exerted in connection with them. For before anything else could be done with goods they had to be produced by the labor of man. Therefore the organizing ability of the race concentrated itself there where its greatest interest and need lay. The problems of production were the ones which seemed most pressing, and the man who improved methods of agriculture or manufacture was the one who reaped the great reward. The manager of industry was engaged in producing more goods at lower cost, and, with the constantly widening market, the matter of selling was simple and called for less concentration of effort and attention.

No colonial problems of marketing. This was true in the early colonial times, when each family, village, or town was more or

less sufficient unto itself. Where such self-sufficiency was to be found, there were no great problems of marketing, for the exchange of goods was almost entirely within the several communities. Producers who found themselves with a surplus bartered it for a share of the surplus of other local producers. There was not very

A FAIR IN PALESTINE

much specialization, and the several members of the community managed to trade among themselves in an informal way, often by bartering or "swapping," and without the formation of anything well-organized enough to deserve the name of a market.

The fair as a market. The first step towards a real market was the fair. A real market is a rather permanent relation between buyers and sellers, whereas the fair was at first an occasional or intermittent relation of the same sort. Fairs were held among less civilized peoples and, in the earlier stages of European history,

once or several times a year. They were very popular, both because they formed the only approach to a large-scale market for the trader and also because the occasion provided a chance for social intercourse between people who did not ordinarily come into contact, and thus furnished them with a variety of diversions which they could not otherwise enjoy. Some of these

A TYPICAL COUNTY FAIR IN THE UNITED STATES

fairs, even among the savage peoples, have been very large; the fair at Timbuctoo was attended by a number of thousands of African natives, as well as by traders of other nations.

The county fair. The fair was characteristic of the earlier history of a number of regions in this country. It was generally known as the county fair and was usually held at the county seat, the farmers coming in from the adjacent country with products of all kinds. Prizes were offered for the best of these products, and of course this led to the advertisement of the skill and goods of

those producers whose showing was most successful. At these county fairs, likewise, there were all sorts of rustic entertainments, such as horse-racing, turkey-shooting, and dancing; and gradually there drifted to the fair grounds the various varieties of entertainers, both respectable and otherwise, who saw in the gathering of population a chance to do business. These county fairs came

COURT OF HONOR AT A WORLD'S FAIR

to be not so much genuine markets as exhibitions of extraordinary products, but they formed, nevertheless, a device looking toward the formation of genuine markets.

The world's fair. The idea of the fair has been expanded into that of the world's fair. Here there is no great market for products, but rather a great advertising device which aims, as we shall see, toward the development of markets and marketing.

The weekly market. Another undeveloped form of market, but one less intermittent than the fair, was the so-called weekly market still common in parts of this country. A certain day in the week was "market day." This day was often Saturday. During the previous night the farmers from the surrounding country would drive into the nearest city, back their wagons up to the curbstones,

set out a table in front, and be ready, almost before dawn, to dispose of the produce of their farms. Customers would set out with a large "market basket" and pass along the lines of tables, purchasing one article here and another there. The sellers generally remained until they had disposed of all their stock, and then set out for home to assemble another load for the next market day. In a number of the cities there was a regular "market house," which stood vacant for the rest of the week but was filled to overflowing during the market day.

ONE OF THE PAN-AMERICAN EXPOSITION BUILDINGS ILLUMINATED AT NIGHT

Earlier forms become antiquated. These illustrations show the more simple devices which came into being for gathering the buyers and sellers together at regular intervals for purposes of exchange. For a long time they were adequate, and, as we have said, the need was rather for more efficient production than for more efficient distribution. The efforts put in on production have brought about a productive organization which has gradually outgrown the earlier forms of distribution through such simple markets as were available. The more production has increased, and the more specialized it has become, the more inefficient have appeared the simpler means developed in former times for disposing of the product.

Produce-marketing. It is to be noted that these earlier devices had to do chiefly with the distribution of agricultural products as

distinct from the ordinary manufactured products. This distinction is not very clear in some cases because many staple food commodities, such as butter, flour, and meat products, have undergone manufacturing processes before becoming available for consumption; but if we allow for cases of this sort we have a clear enough contrast between the products of agriculture and those of

MARKET DAY IN AN AMERICAN CITY

manufacturing. In former times the local store often formed a sort of connecting link between agriculture and manufacture in that it supplied manufactured products in return for those of agriculture. In the earlier days there was not very much money to change hands, and the exchange was chiefly through barter, or "payment in kind."

Rise of the modern market. It has been seen that the simpler devices which we have described were entirely sufficient for the marketing of the products of undeveloped industries. But, as we

have also seen, the prevailing interest was in the higher and higher development of production. This meant that production should become more specialized and that larger amounts of a single product must be disposed of. It was not long before these amounts became too great to be handled by the simpler marketing agencies, and these gradually passed away in favor of the modern market. Here is where the development of transportation allowed of further progress, for the surpluses of production which could not be disposed of within a local area could be transported to some other place where the demand had not been satisfied.

Expansion of the market. In this way the market outgrew the fair and the village store, and people began to think of the marketing of goods as something that would not take care of itself in the natural course of things. There arose a need of higher organization in the marketing of products, and this need has summoned into being a more and more developed and complicated system of disposal of goods. The market is no longer local or even national; it is a world market. Producers have looked farther and farther from home for their customers, until an industry located in the central part of this country relies upon a demand for its products which exists halfway around the world. Thus has come about an immense enlargement of the conception of markets and marketing.

The earlier and simpler conditions of food-distribution. In this country public interest turned first to the problem of marketing farm products. This was because of the fundamental importance of food, for if we look into the matter we find that the average workman spends half or more of his wages for food. Also there was a feeling among the farmers that they were not getting a high enough price for their goods on the farm, and in spite of the lack of coöperation among farmers in securing their interests, their influence was important because of their great numbers. Roughly speaking, a third of the labor force of the country is still engaged in agriculture; and it is no wonder that the marketing of farm products in a country like this should occupy the

foreground. In the older days the farmer was near enough to the final consumer of his products so that there was no great difference between the price received by him and the one that the consumer paid; the profits of the middleman were likely to be moderate.

Concentration of population. But when a considerable proportion of the population became concentrated in large cities, and the development of specialization in agriculture made it necessary for surpluses to be disposed of at greater distances, the farmers became discontented with the wide differences which existed between the prices paid to them at the farm and the prices which, as they learned, were paid for their products in the distant cities. The whole matter of distribution of farm products was made more complex when perishable products, which ripened first in one section of the country, then in another, had to be transported over great distances and sold in competition with products from various other regions. There has arisen, therefore, among the agricultural population a feeling that somehow they are being cheated out of their dues. Very likely they have been, on many occasions; but the situation was inevitable. There had to be intervening stages and intervening men — middlemen — between the farmer and the consumer, and this meant a widening difference between the farm price and the city price.

Growing complexities. In addition to the problem of marketing agricultural products, a very complicated situation is presented in a country as large as ours, with a population of over 100,000,000 people who show wide extremes of purchasing-power. Some are able to buy only the barest necessities of life, while others consume an almost unlimited supply of the highest-priced goods. Between these two extremes lies the great bulk of population, whose purchasing-power is now greater and now less. It is clear that business has grown too big for either agricultural or manufactured goods to be produced by individual order; they must be turned out in large quantities far in advance of their final consumption. In some instances a few manufacturing plants turn

out millions of articles which are exactly alike, and they must be distributed eventually among our great consuming population. It is plain that there are large problems involved in getting manufactured products into the hands of the final consumer without incurring an extraordinary amount of expense, time, or waste.

Enforced complexity of the distributing system. The result is that the distribution of food and raw products is now accomplished by an elaborate organization of local dealers, middlemen, coöperative associations, produce exchanges, warehouses, elevators, cold-storage plants, and public markets. Also the tremendous output of our manufacturing plants must be disposed of through a long line of jobbers, wholesale and retail dealers, general stores, direct selling, and advertising. A study of the historic development of any one of these organizations or parts of them would show that they have passed through various phases of development as they became better adapted to the general needs of the situation. But it is commonly admitted that in this country the marketing of goods is that part of our business organization which shows the least efficiency at the present time, and in all probability great changes in methods of marketing both raw materials and finished products are due in the near future. Let us look at some of the various methods that have been worked out for the marketing of goods.

The three stages of marketing. There are three stages of marketing which may be distinguished: the earlier sales were made in bulk; later on they were made by sample; and in most recent times they are made chiefly by description. In the first case, before the purchaser bought anything he always saw the exact goods which he was purchasing. In the second case, when goods came to be better standardized he bought without seeing the articles, but in reliance upon the good faith of the seller as a guarantee that the deliveries would not be inferior to the sample. It was the introduction of machine methods in industry, whereby large quantities of a standardized product could be turned out in a short time, that gave the stimulus to the development of sales

by sample. It is plain that more had to be taken on trust in the second form than in the first; and when goods came to be sold by description, there was assumed an even higher standard of honesty and also a higher level of general intelligence on the part of purchasers. Sale by description is, of course, one of the many developments which have been rendered possible by the printing press.

Sale by description. Sale by description is the typical modern method. There are certain products which do not naturally come under this form. For instance, live stock cannot well be sold in that manner, and most perishable fruits and vegetables must be looked over to see what condition they are in before purchase. Some products, potatoes, for example, are apt to vary so greatly in quality and size that they cannot well be bought even by sample, for uniformity in quality and size are essential to successful sample selling. On the other hand, apples and many other fruits are now sorted and packed in a standard way, so that one barrel is an index of what the whole lot is like. One of the best examples of a commodity which lends itself to selling by sample is grain, because grain runs rather uniform in quality. The selling of goods by description rather than by the other methods lends itself better to manufactured goods than to farm products. Perhaps the typical form of selling by description is shown by the great mail-order houses; their vast catalogues, issued at a great cost, are really textbooks of sale by description.

Combinations of methods. When goods are sold in bulk the intervention of the middleman is not a necessity, but when the sample method is in vogue the sales are actually made by middlemen or salesmen, while in case of the disposal by description the chief resort is advertising, although middlemen and salesmen may be used. All sorts of combinations of methods and agencies for selling occur, and this makes the problems of marketing very complex. What the dealer has to do is to work out such combination of methods and agency as will give him the most efficient system of distribution, or marketing.

The middleman. But, it will be noted, the development of the productive industries has had as a result the development of a new profession, that of middleman. More and more of these specialists have been introduced between the producer and the consumer, and they have secured a position of dominance over both of the original parties. The middleman is in a position to squeeze the producer and to impose upon the consumer. Hence there has been a tendency in recent years toward more direct methods of selling; that is, toward the reduction of the number and power of the middlemen. However, the function of the middleman is a necessary one, and he deserves what he gets so long as he does not abuse his position. He shares a risk on goods, helps to finance the enterprise, and actually sells the products. The middleman was originally a necessary and a good development; it is thought by some that he has come to be an unnecessary evil; the hopeful view is that, if competently controlled, he may retain or resume his position as a recognized and serviceable factor in economic life.

Need of knowledge and efficiency. The foregoing paragraphs should give the student some idea of the complexity of the marketing situation, as well as of the importance of having a well-knit and efficient agency operating between the producer and the consumer. The inevitable extension of the market created a situation never before experienced by human beings, and they were obliged to develop an organization to deal with it. This organization grew up without anyone having given it great study or other attention, and has discharged its purpose with considerable efficiency. But its very faults have combined to serve notice on the world that the matter of the marketing of goods is one important and complex enough to demand the best possible brains of the race for its study and solution.

The marketing of exports. What we have said above has had reference chiefly to domestic conditions; but if we consider the matter of export trade, still wider marketing problems arise. These are connected rather more with the disposal of manufactures than

with the sale of foods and raw materials; for while the latter presents very important marketing problems, the competition in the markets for manufactured products is somewhat keener than in the markets for foodstuffs and raw materials. In order that our manufacturers and exporters may gain control of the market for certain lines of manufacture, the most scientific of business methods must be employed; the foreign department of a business will not look after itself, but demands the most constant attention and the most efficient organization.

Direct and indirect sale. The American manufacturer may sell his product in the foreign field either directly or indirectly. By direct selling we mean that he may, for example, make larger or smaller sales abroad merely by advertising his goods; or, again, he may sell his goods directly to the foreigner through salesmen of his own. The manufacturer who makes use of the method of direct selling employs no one outside of his own firm. He may rely upon his banker and upon some forwarding agent, but the actual marketing is done by the establishment itself. In some cases the American manufacturer gets better results by indirect selling, that is, by disposing of his goods through a commission house or through some export agency. This method of selling indirectly rather than by establishing his own export department means that the merchant must exercise a good deal of supervision over the professional exporters.

Marketing through branch corporations. The very largest industrial concerns in this country have gone so far as to create branch corporations to take charge of their foreign business. Thus, the United States Steel Corporation has such a branch concern, known as the United States Steel Products Company, and the United States Rubber Company has the United States Rubber Export Company.

Forwarding agencies. Whether the selling is direct or indirect, goods are actually forwarded by forwarding agents, who are specialists. For example, our express companies are able to make out a bill of lading from the point of shipment to a destination

at almost any other point in the world. They are accustomed to assemble a number of small consignments from various sources, list them upon a single bill of lading, carry them to some foreign port, where they are entered through the customs by the forwarding agents, and then sort and dispatch them to their respective destinations. This is a great economy, for it saves freight charges by taking advantage of through rates and minimizes expenses and trouble in both port of clearance and port of discharge.

Meeting the tastes of foreign consumers. Of course this is only a part, though an important one, of the organization for securing foreign markets. The successful and continuous selling of goods abroad is a product of many factors. Export merchants and manufacturers must study every detail of the foreign business as a unit by itself. For example, goods must be made differently for different markets; we cannot impress our own styles and tastes upon the South Americans or the Orientals. We have been too self-sufficient in that matter and have acquainted ourselves too tardily with the racial differences and varying social customs of foreign peoples with whom we wish to trade. We must produce things, and even put them up, in such forms as our customers want them, not as we think they should have them. They have as little sympathy, or as much contempt, for our styles and fashions as we could have for theirs.

Dangers of self-sufficiency. It is always the prime function of the trader to please his customer, and particularly to avoid treading upon any of his prejudices, ridiculous though they may seem. This is a very simple and obvious principle, but it has taken every great trading people some time to learn and apply it. It is the conviction of every nation that its own ways are right and expedient and that other peoples who differ with them must, as a matter of course, be wrong. So long as we have no favors to ask of the rest of the world we may not suffer from preserving this narrowness of mind, but if we actually mean to conquer our share of the world market, the sooner we give up our intolerance the better.

CHAPTER XXXII

THE FINANCING OF INDUSTRY AND THE DEVELOPMENT OF CORPORATIONS

The importance of capital. In preceding chapters we have seen the importance to industry of an adequate labor supply, especially if it is of high quality, and we shall consider that matter further in the following chapter. But there is another element of the highest significance for the destiny of a country's industrial life, and that is capital. It is perfectly fair to say that the whole structure of material civilization rests upon labor and capital, and no less upon the latter than upon the former. If we were to sketch the growth of the industrial organization from its simplest and most primitive forms up to those of the present day, we should find that every considerable advance that had been made depended upon the presence and utilization of capital.

Scarcity of capital in new countries. In every new country capital is scarce. It takes a good while to develop a surplus of capital sufficient for embarkation upon industries much in advance of agriculture. The American colonists brought some capital with them in the form of seeds, goods, domestic animals, and other directly useful possessions, but for a long time wealth accumulated so slowly that industrial development financed with American capital was almost out of the question. As a matter of fact early colonial enterprises were financed very largely with English funds.

Colonial capital. It will be recalled that the colonists were substantially equal in the matter of property. There were few

of the very wealthy, as of the very poor. People worked for the most part in occupations that did not demand a heavy capitalistic endowment, and the colonists were so conservative that they were very slow about putting their scanty savings into the development of new and untried industries. In some of the Eastern cities on the seaboard, especially Boston, New York, and Philadelphia, certain successful traders and shippers were able to accumulate a surplus, but they were more interested in commerce than in manufactures, so that their spare funds did not ordinarily go into the building up of the latter.

Growth of American capital. In the seventeenth century accumulations became greater, and there are reported to have been in 1680 about thirty Massachusetts merchants worth between $50,000 and $100,000, whereas an earlier generation considered $22,000 to be a great estate. In the eighteenth century the process of accumulation went on rather rapidly, especially in Pennsylvania; Philadelphia money supported ironworks and other manufactures as far south as Virginia and the Carolinas. Men who had acquired their fortunes by manufacturing became supporters of sound undertakings and critics of unpromising ventures.

Forms of colonial investment. However, foreign capital was generally behind the leading colonial manufacturing plants. After the colonists began to invest, it was generally in enterprises where manufacturing and commerce were combined; in fact, since many manufacturing concerns marketed their own products, these two forms of enterprise, production and marketing, generally went hand in hand and were commonly managed directly by one man or one concern. The corporation was a product of the latter part of the nineteenth century.

Post-Revolution conditions. Only a relatively small amount of the total capital engaged in manufacture was sunk in building and machinery; it was employed largely in operating the plant, being necessary on account of tardy transportation and long correspondence, which delayed returns from sales. Not until after

the Revolution did conditions begin to shape themselves so as to favor the development of new industrial enterprises. About that time banking and credit facilities were much improved, and the rapid expansion of American commerce caused a speedy accumulation of wealth in the hands of Americans engaged in shipping. Commercial capital soon became greater in proportion to population than ever before.

The small demand for capital. In the earlier days, when a man put his money into a concern, he had usually been able to inform himself by direct examination concerning the nature and prospects of the industry, and very frequently knew a good deal about running it from having been connected with it. The case was quite different from what it is at present, when people buy stock in a corporation and hope that those who have charge will manage its affairs so as to pay dividends. There were at that time no large private fortunes to be drawn upon; in fact, there was not yet a great mass of floating capital which could be relied upon for the development of new projects. We find that many early industrial plants were established and expanded by enterprising individuals who had faith in the development of the industry. It took little capital to set up a water-power mill, and if it was successful the earnings of the owner and the savings of the few operatives often furnished all the capital needed for expanding the business. Thus did the small mill develop into a large factory. Farmers and other neighbors came in with contributions of land and mill-sites, and often with personal labor. From these informal partnerships or associations arose the early joint-stock companies, out of which grew the small corporations characteristic especially of New England.

Government enterprises. But the lack of capital remained a serious drawback to the development of manufacture. It was even suggested that several millions of dollars be set aside by the government to loan to manufacturers at a low rate of interest. The separate states embarked in industrial enterprises, especially in connection with transportation and banking. The Federal

government itself built the Cumberland Road. And so it was that during the first three or four decades of the last century our governments, both Federal and state, were financially interested in some of the most important industrial enterprises of the country.

The call for capital. The introduction of the steamboat on Western waters and the spread of cotton culture into the Southwest started a rush of material development, which called for a large amount of capital, particularly in connection with transportation works. Canals and turnpikes represented undertakings of a size scarcely imagined by the preceding generation. The capital required was derived in part from the savings of Americans and in part from abroad. There had been a good deal of accumulation, especially in the East and South; but foreigners, especially Englishmen, had, during the first half of the nineteenth century, large sums of money to lend, and the United States formed an attractive field for investment. Up to the middle of the forties England seems to have had in her own industries no adequate field for the employment of all her capital, and she invested very large sums in this country.

The beginnings of the corporation. Corporations were not unknown before 1850; they appeared as soon as industries grew to a point where they demanded more capital than could be supplied by a single individual or by a partnership. But corporations were not able to raise millions without the backing of the government; there were no big banking houses to underwrite securities and to insure the successful floating of new corporations. And so the governments of this country, instead of guaranteeing the interest on bonds of corporations, undertook to embark in the industries themselves, and government-owned enterprises developed on a large scale. It was with the failure of many of these that the states withdrew and left the field free for the modern form of development. However, it should not be understood that the states entered much into manufacturing; for some time that form of development was exceedingly slow as

compared with its pace after the Civil War. Manufacturing plants that had been owned chiefly by individuals or partners were unincorporated joint-stock companies; it was in the cotton manufacture that corporate organization very soon became common, and then the corporations spread into other lines of textile manufacture and into the iron industry.

Nature of the corporation. It is characteristic of a corporation that it exhibits (1) an artificial personality; (2) joint association in ownership; (3) limited liability of stockholders. The first point marks its distinction from ownership by an individual or by several individuals, and the third means that stockholders are responsible for the obligations of the corporation only in proportion to the number of shares which they hold, whereas in a partnership with unlimited liability the part owner is responsible for all the obligations of the concern. The idea of limited responsibility in a joint-stock association runs back for four centuries or more, but the genuine corporation has come into prominence in the economic life of the world only within comparatively recent times.

Conditions favoring the growth of the corporation. The business corporation is really a product of the nineteenth century. It demanded certain industrial and political changes to pave its way. Before there was any great industrial expansion an end had to come to the conferring of special privileges by sovereign power upon individuals, and there had to be a rather general triumph of democracy — changes which came to pass during the latter part of the eighteenth century and the beginning of the nineteenth. The purely industrial changes came about with the so-called Industrial Revolution, which accompanied the utilization of steam power in industry and transportation. This led to the establishment of industries on a scale so large that their financing was beyond the capacity of an individual or even a partnership; and so a new method of organizing business was necessarily developed, which could be provided either by the state going into business enterprises itself or by delegating its powers to

corporations. But we have seen that in this country the state governments, after sad experience, withdrew from business, and in this way was opened a field for the development of genuine corporations.

The corporation was inevitable. There has been a great deal of objection, on various grounds, to the corporation. No doubt there have been unfortunate sides to its development and a number of abuses, but it is difficult to see how this leading form of industrial organization could have been evaded. It has been like some new and powerful engine which men have not understood very well and which has, therefore, caused a good deal of suffering and injury to certain parties. But in such a case the only recourse is to learn how to manage the new power, not to discard it and try to carry on by outgrown methods the enormous industrial organization of the twentieth century.

Extension of the corporation. If the corporation had been a bad thing in itself, it is hard to see how it could have made such headway and shown such results. It is to-day the dominant form of business organization; practically every important line of industry considered in the foregoing chapters is organized in the corporate form, farming being the most notable exception. Four fifths or more of the products of our manufactories are turned out by corporations; and this is true despite the fact that only about one fourth of the total number of establishments are on the corporate basis. This means that there are numerous small concerns engaged in manufacturing, but the corporations employ three fourths or more of the wage-earners employed in this line. In transportation and finance the corporation occupies a leading place. There were on a recent count about 270,000 corporations in this country whose outstanding stocks and bonds amounted to over $88,000,000,000 and whose reported income was about $3,860,000,000.

Increase in size of the business unit. In preceding chapters we have seen that many of the industries of this country took on new life after the Civil War. The old small-scale production,

with small capital, was supplanted by something more nearly commensurate with the expanding development of our natural resources. There appeared not only the concentrated and centralized type of management but also the great captains of industry; the small independent producer disappeared, and laborers were organized into larger and larger units. Of course such combination and concentration would have been impossible without the development of standardization of machinery and methods, the development of adequate accounting systems, the invention and improvement of the telegraph, telephone, and typewriter, and the building and organization of railroads. The great expansion of the railroad system came, as we have seen, after the Civil War. This greatly widened the market and called for a pronounced expansion in the size of the business unit. Large combinations of capital — trusts, as they were commonly called — came to dominate many of the leading interests of the country. These consolidations were few until the last decade of the nineteenth century, but from 1898 to 1903 there was tremendous activity. The largest combination of all — the United States Steel Corporation — was founded in 1901, with a capital of $1,100,000,000, besides $304,000,000 in bonds.

Economies of combination. Combination, like other advances in the organization of industry, was forced by the necessities of the case, for the older devices for managing industry and trade had been outgrown. Combination represented economies of several sorts and so was a welcome device in an industrial competition where every saving counted.

The wastes of competition. By the very fact that it limited competition, combination did away with the wastes of competition and also rendered possible the economies connected with large-scale production. The fact that it aimed at monopoly-power should not blind us to these facts. The main wastes of competition have to do with duplication of expenses in advertising and in paying salesmen and also with the uneconomical use of plants. In regard to the last point, plants are most economically run when their

management represents the best knowledge and talent available. Thus managed, each plant will be doing the best it can for itself, and if there are a lot of smaller plants under a common talented management, the work of each plant will be apportioned so that it is doing what it is best fitted to do. Such combined plants will therefore be more prosperous than they could be if they continued to compete with one another under cheaper management. It should be realized, however, that there is a limit to the size of the business unit which can be efficiently handled; after a certain size is attained the supervising expenses increase entirely out of proportion to the advantages secured.

The economies of large-scale production. The economies of large-scale production are almost self-evident; everyone knows that articles that can be made by the thousands are produced much more cheaply than those which have to be made separately or in small quantities. It may cost a publishing concern, for example, a good many thousands of dollars to turn out the first copy of a book, but if the sale is going to be large enough, copies can be sold for a nominal price. The modern newspaper is a good example of the low price of an article produced on the large scale.

Monopoly. The desire for monopoly is an important cause for combination and is the one generally associated with the corporation or trust. There are both advantages and danger in monopoly. In some lines of industry, such as transportation, gas works, and telephone service, a monopoly is almost inevitable, and the dangers to the public which would arise from the ruthless use of this power have to be minimized by careful supervision of the companies by the state which grants them their charters.

Advantages of the corporation. If the corporate form of organization had not had its advantages, it could scarcely have developed so strongly and permeated almost every branch of modern business organization. It is worth while to point out several facts about corporate organization in addition to what has already been said.

Permanence. One of its leading advantages is its permanence: it need not die, but may continue for hundreds of years. In case of a business owned by a single individual, on the contrary, the death of the owner generally means that it has to be wound up or transferred to a successor; very often it has to be sold to close an estate, and not infrequently at a great sacrifice. Similarly with a partnership: the business is thrown out of adjustment when a partner dies, and, although the surviving partner can buy out the heirs, disputes are likely to occur and there are all sorts of hazards, especially to the heirs of the deceased man. By contrast, the corporation is not necessarily involved in difficulties by the death of even the largest stockholder, for someone else can succeed to the ownership of the stock, and as long as the corporation is well managed it shows no change.

Accumulation of small capital. Another advantage of corporate organization is found in the fact that it provides a means for financing, by the collection of small sums from numerous individuals, undertakings completely beyond the ability of one or a few persons to carry. The shares of stock may be placed at any denomination from ten cents upwards, and thus millions of dollars may be collected from thousands or even tens of thousands, who are thus enabled to take their small share in a large enterprise. Naturally all such enterprises are not legitimate and profitable, but it must be realized that, after all, the real capitalists of the country are the multitudes of small stockholders rather than the few large ones. There are so many more people in moderate than in affluent circumstances that without the combination of the small savings of the former it would be hardly possible to run many of the largest enterprises.

Limited liability. This ability of the corporation to render possible a larger industrial development than could take place without the collection of small sums is favored by the limited liability feature of which we have spoken. A buyer of a share of stock, if it is fully paid and nonassessable, cannot lose more than the price of the stock. Now it is perfectly plain that no poor

man who had saved one hundred dollars would dare put it into any enterprise if he were going to be unlimitedly responsible for the obligations of that enterprise; he dares to risk the actual sum he puts in where he would not dare stake anything more. He is in no position to pay debts contracted by other people, even if these others are not criminal rascals. But, safe in his limited liability, he is able to contribute his mite to his country's industrial development and also to derive his proper share of profits from it.

Ease of entrance or withdrawal. A further advantage of the corporate form is that one can withdraw from a corporation quite easily by selling his share on the market. A partner cannot so readily withdraw from a partnership, for many a partnership has been dissolved only after disagreements and even after appeal to the courts. This ease of withdrawal, which is matched by a similar ease of entrance, allows a mobility of business movement which makes the whole organization more flexible and more adaptable to the needs and crises that may arise.

Disadvantages of the corporation. If there were no disadvantages in the corporate form, every business, large and small, would be so organized. What are these disadvantages? There is the cost of incorporation; then, again, the officers may be less careful in their management than they would be if they were the sole owners; again, there is a disadvantage in the fact that a corporation is more subject to governmental control than is an individual or a partnership. Furthermore, it is objected that in large corporations the separation of the employer and employee, and their consequent lack of sympathy with one another, is greater than it could be in smaller concerns. The stockholders who control the policy of the corporation may never have seen certain large portions of its plant, much less have met the persons there employed. This is one of the reasons why a corporation is spoken of not only as impersonal but also as soulless.

CHAPTER XXXIII

LABOR ADJUSTMENTS

Importance of labor. In the preceding chapters we have seen the importance of capital to the development of our industries. We have seen, indeed, that capital is indispensable to the growth of civilization itself. But there is another factor in the development of both industry and civilization which is fully as important and probably much older than capital, namely, labor. Without labor the resources of a country are of no present use. Perhaps in some of the Pacific islands at the time of their discovery there was such exuberance of the products of nature that the natives lived in a sort of paradise without much work, but it is perfectly plain that the highest civilization has never originated in such favored spots. It is not only a necessity that man should labor but the fact that he is obliged to do so is good for him and for the progress of mankind. In general, the highest civilization is to be found where men have been most industrious, and the most civilized races are those in which the habits of industry have become the most firmly fixed.

Need of labor in a new country. We have seen that land is of no avail without men, that is, without the application of human effort, and that this effort is more successful if the men are of high quality, both of body and of intelligence. In any new country the quantity of labor necessary to overcome the difficult pioneering conditions, so as to work on up to easier and more modern systems, is very great. In the American colonies, as always on

the frontier, there was much work to be done at the same time that labor was scarce. There was so much land, and it was so cheap, that the tendency was for newcomers to take up new land rather than to work for wages. In the North the farms were small, and the owner and his family did the bulk of the work, hiring what little help they could. Farmers coöperated with one another in such enterprises as house-raising or barn-raising, where a number of laborers were needed. This coöperative plan has been natural and inevitable under similar conditions up to the present day. If the reader will recall what has been said in Chapter IV about the conditions in a temperate colony, what is here said will take its proper place in the perspective. He will also see how in the South, where large plantations and a staple crop were the order of the day, more crude labor was needed than was called for farther North.

The colonial labor force. But in all the colonies, especially when other industries were added to agriculture, the crying need was for labor, and various schemes were devised for obtaining workers from Europe. Because of the much land and the few men, and the consequent fact that the immigrant naturally became a landowner rather than a wage-earner, the first servants were largely "redemptioners" or slaves. Of the latter we need to say no more, for we have considered the case of the slave in Chapter III. The redemptioners, or indentured servants, were in reality in temporary servitude, for, not having any funds, they contracted debts for their transportation and were sold to work out these debts after they arrived. But even they, when their terms of service were over, tended to become independent proprietors.

Immigrant labor. If the colonies felt the lack of labor while agriculture was as yet almost their only industrial interest, they felt it still more painfully when manufacturing began to take a start. A number of writers in the earlier days asserted that the scarcity of labor had checked the introduction of manufactures, and the factory system with them, into America. Before the immigrants came in large numbers manufactures could flourish

only where the work could be performed by women and children or where men could sell their time in dull seasons. This is the way in which the textile and the boot and shoe industries, for example, were built up; the textile industry was the first to be organized on a modern scale in this country, and it was built up principally by the labor of women.

Preference for agriculture. There was still another reason for the backwardness of manufacturing development. The attraction of the independent life of a landowner was always drawing even the skilled newcomer away from his old occupation into agriculture, and the sentiment of the community so favored the more independent pursuit that both habit and social prejudice conspired to depreciate manufacture. It came to be associated with poverty, especially since the use of pauper labor in British factories had fixed a lasting stigma upon such employment. And in the South, as well, labor in general came to be thought of as a servile occupation — a fact which strengthened the natural tendency of the colonists to seek independent employment. This is one of the main reasons why it was harder in this country to divert men from farming to industrial pursuits than it has been elsewhere.

Development of the factory. But this situation was greatly modified by the influx of immigrants, for that made possible the organization of labor in a considerable number of industries and favored the adoption of the factory system in many other branches than the textile. Even before the Civil War the part played by immigration in American industry was very great, for while the number of immigrants was small their contributions were the more needed. At times there was great industrial unrest in England and on the Continent, which drove many skilled workers to America, where they expected eventually to become proprietors of factories of their own. Many of them realized their hopes and became pioneers in great industries which developed later, introducing into this country the arts which they had learned in Europe. It is said that the infant industries of Pittsburgh were conducted largely by Scotch and English workmen, and our textile factories

in New England were kept going by skilled operators from England and Ireland. The British immigrants in particular were very largely skilled workmen and were exactly what we needed in the beginnings of our industry.

Excellent quality of the early immigrants. The impetus given to American manufacture by such advantages enjoyed during its earlier stages is difficult to overestimate. Power spinning and weaving, the use of coal and coke for smelting iron, the use of puddling furnaces and rolling mills, were advantages that accrued from deriving skilled laborers from a land where the industries were more highly specialized and more advanced in every way. England had been forced by the scantiness of woodland to the use of coal, and because of large markets and the easy transportation that had been developed she had been enabled to stride forward to wholesale production. The use of chemicals for dyeing, as well as other applications of science to industry, were the natural contributions of old communities possessing ancient institutions of learning, ample capital for experimentation, and a market for luxuries. Some of these inventions were so dependent upon conditions not then existing in America that when one of our manufacturers chanced upon one of them it might not come into practical use until it had been re-introduced from abroad.

Skilled labor. The fact that when our industries were in their formative stages the ranks of our laboring classes were being recruited from countries industrially far in advance of us, and recruited also from a high-grade class of laborers possessing a good knowledge of machines, was a considerable factor in our earlier and later successes. The truth of this can be seen if one tries to imagine the result, had the bulk of these immigrants come, at that time, from the same regions from which the bulk of them now come. This will recall, again, our repeated contention that America was very fortunate in the quality of the human element which she was able at the outset to draw from Europe.

The need of unskilled labor. Between 1860 and 1880 immigration was proceeding at a rapid rate and our industries were fast

expanding. Over five million immigrants arrived in this country during this period, but their presence was so much needed that they were successfully absorbed. The building of railroads and the development of the metallic industries called for ever larger supplies of both skilled and unskilled labor. The West was settled very largely by our native stock, whose relinquished places would not have been taken except for the multitude of newcomers who filled the gap in the labor supply and thus prevented a check on growing manufactures. Skilled labor is always in demand, but the improvements in our industries, and especially in automatic machinery, made it possible for us to use unskilled labor in our factories with considerable satisfaction. Up to 1880 nine tenths of our immigrants were from Germany, Ireland, Great Britain, Canada, and the three Scandinavian states, and were vigorous, thrifty, quick to learn, and easily molded into the American type. Yet they were, in their day, mostly unskilled, and so took a lower position in the industrial organization, while the natives rose to the higher ones. Those who wish to limit immigration should not let slip from their minds the fact that there was an immensity of hard and rough work, much of which demanded little more than willing hands, but whose performance was indispensable to our industrial and social development; and that if the immigrants had not been on hand to do this work, either it would not have been done at all or much else that was done would have had to be omitted.

Rise of the immigrant. It is a fact, as we have seen in a former chapter, that in later years this country has been the refuge of those who have had very few chances at home, and also of many whose manner of life does not fit into ours very well; but if the whole course of immigration into this country is considered, it is seen that, although every new set of immigrants was slipped in, as it were, at the bottom of the social pile, yet under the system of freedom and opportunity characteristic of this country it has always been possible for the industrious and enterprising to work themselves up among the older and higher layers. This

has been the Land of Promise for many decades to hordes of the miserable and oppressed; and there is no doubt but that the opportunities accorded have been happily taken advantage of by thousands. And at the same time this country has profited by the labor supply afforded it at a time when that supply, even though of low quality, was much in demand. This is certainly true, whatever doubts one may now have about the continuance of our free-and-easy methods in the matter of immigration.

Colonial wages. The conditions of labor in colonial times, even when such labor was free, seem to us, in the light of present-day conditions, quite bad; and this is true of the early part of the last century. An unskilled workman would earn something like fifty cents a day, and the working hours were from sunrise to sunset. With the opening of the West the condition of the unskilled laborer somewhat improved and he received a dollar a day. It must be realized that these sums represented at that time a much higher purchasing power than they had later. There was not so much to complain of as one would judge at first sight; and then, of course, labor was so far from organized that any complaints that did arise were local and isolated.

The labor movement. But during the third decade of the last century there arose what might be called a real labor movement. It did not start because of bad conditions in our factories, for outside of the textile industry, which employed mostly women and children, factories of any size were few. What movement there was grew up as a protest against a system, developed by merchants and capitalists, which, it was thought, was reducing mechanics of various degrees of skill to a common level of wage-dependency. This movement, as well as a number of others before the middle of the century, had only a brief career. A trade-union movement was developed about 1853 which showed more strength and in which attention was directed toward bettering conditions in the trades; and, after the Civil War had shown that industries were to be run by free labor, most labor movements were in the direction of improving the conditions of the free laborers.

Labor organization and legislation. All through this book we have noticed that the middle of the nineteenth century and the Civil War have formed a point of departure for industrial development of a higher order in many fields. The growth of population and its tendency to concentrate in cities, together with the marked development of manufacturing industries, evoked new labor conditions of a more modern order. The size of the industrial plant increased and the workman was no longer personally known to his employer. But when people who have business relations are thus separated, they naturally fall out of harmony with one another and into a mood of suspicion and opposition. Conflicts arose between labor and capital; then labor was more firmly organized and began to bring about the large mass of labor legislation that had to do with hours of labor, employment of women and children, and other such desirable reforms which cannot in all cases be expected from employers. The bulk of such legislation has been passed since 1880, but Massachusetts had led the way as early as 1866 by passing an eight-hour law for children under fourteen. Most of the early labor legislation was in favor of women and children. Improvements in labor conditions have been brought about largely by the creation of organizations so that laborers could act as a unit in looking after their interests.

The labor union. Prior to the Civil War there were very few labor unions in this country, but many were formed between 1860 and 1870 in connection with the most important trades. The strike was the weapon used by the labor unions to secure their ends; but it was not until the late seventies that strikes became significant enough to attract public attention; it was in 1877 that a widespread railroad strike gave the American people their first realization of the problems which the great growth of industry and the creation of much wealth were bringing upon the country. Whether or not we credit it to the labor organizations, it is a fact that labor conditions have greatly improved during the last few decades; working hours have been shortened, wages have risen, and the general condition of the bulk of industrial

workers is much more satisfactory than it was before the Civil War. Outside of the body of industrial workers such progress has not been shown; and this is particularly true of the agricultural laborers, who could not very readily organize and whose wages and hours of work have remained until very recently much as they were a half-century ago.

Capital and labor. It is not our intention in this place to enter into the pros and cons of the many disputes between capital and labor. We shall describe several movements which have resulted in better relations between the two, as examples of what may be won by intelligent study of the conditions. But it should be recognized by every intelligent American citizen that capital and labor cannot be independent of one another but must always be interdependent. Industries cannot exist without the laborers or without the capital, nor can the laborers exist without the industries and the capital behind them. The interests of the two parties should be the same, and it is to be hoped that some form of adjustment will be arrived at so that industrial peace will come out of what has so often been industrial war. The capitalist cannot accept dictation from the laborer, nor can the laborer consent to allow the capitalist to dictate conditions of employment. Discussion and coöperation between the two is better than is dictation on the part of either. Increasing responsibility on the part of the capitalist or the organization which he represents, on the one hand, and the laborer or his trade union, on the other, is essential to the carrying out of whatever agreement may be made between the parties.

Employers' liability. In recent years we have turned our attention to the safeguarding of the life and limb of the laborer. Under the common law the employer has long been required to afford his employees safe labor conditions. He was not, however, responsible for injuries caused to workmen which were "incident to the business," nor was he liable for the negligence of a fellow servant. Consequently an employer, if he so desired, was until recently able to shift practically all responsibility for industrial

accidents upon others than himself. But many states have now modified this common-law doctrine so as to make the employer assume liability in many more cases of accident than formerly. In 1914 we had practically no workmen's compensation laws in any of the states, whereas, at the present day, there are few states without such laws.

Workmen's compensation. The compensation of workmen who meet with accidents is vitally connected with very grave social issues, especially with that of poverty. As the factory system has grown to larger and larger dimensions the world has experienced a tremendous industrial expansion, and along with this there has grown up notorious disregard for human life. In a single year in the United States a half million or more of laborers are killed outright or injured; and many of those who are injured are disabled for life, while others are incapacitated for varying periods. And then there are the families which are dependent upon the killed or injured workmen and which, because of the loss of income and the extra expenditures involved, often fall into a truly pitiable condition. It is plain that industrial accidents should be reduced to the lowest possible number and that proper compensation or indemnification should be provided. All such human misery should be reduced to its lowest limits. But this is a knotty problem, for justice must be done at the same time to both the employer and the employed.

Industrial accidents. We have seen that until a few decades ago the whole burden of industrial accidents, excepting those for which the employer could be shown to be solely to blame, had been borne by the workman. The idea which prevailed was that the workman in taking the job would figure on the peril to life and limb, and that as a consequence of his steering clear of dangerous occupations there would be a scarcity of laborers in them and the wages would be so high as to justify the venture. But this theory, like so many others that neglect the plain facts of life and of human nature, did not work out. Laborers have only the most general idea of the danger of occupations, and they do

not expect to suffer by them. There are usually plenty of candidates for positions as switchmen on railroads, although the occupation is a hazardous one and is not highly paid. What the laborer out of work generally has to do is to take the job which he can get; he is seldom well enough off to wait until he can pick and choose. Thus the plan for making the individual laborer work out his own salvation in taking a job and standing the risk does not succeed.

Evasion of compensation. On the other hand, the plan of employers' liability as it existed under the common law did not prove satisfactory. An employer could evade liability by establishing any one of three defenses: (1) contributory negligence, (2) assumption of risk, and (3) the fellow-servant rule. The first of these means that an injury is caused by the negligence of the injured man; the assumption of risk means that if there is an injury caused by a danger inherent in the occupation, the employee is as well able to protect himself as the employer to protect him; and the third defense rests on the contention that if an injury is caused by the negligence of a fellow workman, the employer is not liable. According to the common law the establishment of any one of these defenses nullifies the liability of the employer; but, as can easily be seen, no one of the three would be very difficult for a sharp lawyer to establish.

Workmen's compensation laws. When it was found that this common-law system of employers' liability was full of defects, and that only a small proportion of the injured received compensation, the remedy was sought in the adoption, by the various states, of workmen's compensation laws. The general theory back of these laws is that industry should assume the burden of loss of life or the burden of accident, just as industry bears the expense of new machinery or of repairing old machinery. The machine helps to make the product; so does the workman. If a machine is broken it must be repaired or replaced; and similarly if a workman is injured or killed there must be a reparation and compensation. And there is also behind these compensation laws

the general principle that compensation shall be forthcoming without regard to the question as to whose fault it was that the accident took place. This enables every person injured in the course of duty to obtain compensation in proportion to the degree of disability incurred.

Insurance. This puts a considerable risk upon the employer, and he generally takes recourse, as in the case of other risks, to insurance. The upshot of the laws is, then, that employers must incur an additional steady expenditure in order that the workman may be protected; it is, of course, possible for the employer to pass this item on to the consumer in the form of a higher price for the product, so that the public pays. But it is a service to society to protect and compensate its members against the risks of life, and society has seemed well content to shoulder the burden. In any case, there is now no uncertainty as to the basis of liability, nor yet concerning the amount of the indemnity, for there are definite schedules covering this matter; and it is now reasonably certain that the injured will be able to collect promptly, whereas under the older system there might be protracted bickerings and legal procedure leading to a barren result in the end. It looks very much as if we had worked out a system much better adapted to comfortable living than was the one which preceded it.

Group life insurance. A new phase of insurance, designed for the benefit of the employees of a concern, is what is known as group life insurance. A number of companies have recently adopted this as a Christmas gift or bonus to their employees. This form of insurance is designed to increase the efficiency and stimulate the loyalty of the workers, so as to strengthen mutual good will and make the business relations between employer and employee closer and more permanent. The amount of insurance has for its basis generally a year's wages or salary, with about $3000 as the limit; or each employee is given $500 or $1000 worth of insurance which is to be increased, up to a certain point, by $100 annually for each additional year of service. Group life insurance is ordinarily carried, for the concern in question, by one

or more insurance companies; but in some cases it is assumed by the employing corporations themselves, just as some large shipping concerns insure their own vessels rather than have them insured by companies.

A case of insurance. In illustration of this device we might mention the case of the Union Pacific Railroad, which, on January 1, 1917, had 35,000 to 40,000 of its employees insured without any cost to themselves, the company carrying the premium. They were also insured in a large casualty company against loss by accident and sickness. The total insurance amounted to about $30,000,000, and the annual premium charges to about $750,000.

How "having a heart" pays. It is entirely likely that projects of this sort really pay in the end. It is impossible to ignore the fact that human beings have emotions, and that their efficiency varies with their state of mind. If a laborer is always worried about the future, and thinks that his employer has no interest in his welfare, he cannot work with the zest or the success which he might attain if he had more peace of mind. There are types of laborers upon whose stupidity or bad disposition no amount of consideration will make any impression. If they are given an inch they will take an ell. Such persons do not deserve consideration. But the ordinary normal human being is the one for whose benefit these schemes are devised, and the preliminary returns seem to prove that real results are obtained.

The labor question. The question of labor, like that of capital, is one upon which many volumes have been written. It is out of the question to make any complete survey of the various plans to promote its efficiency which have been tried. But the above paragraphs describe some of the most important conditions and devices for securing adjustment that are connected with this subject, and exhibit the historic trend of events which has accompanied the development of our industries since colonial times.

SUMMARY AND CONCLUSION

Retrospect. And now, in the course of this book, we have set before the reader a series of fundamental facts out of the history of American industries and trade. The first essentials were the land and the people, and we briefly described the productive areas, with their natural resources, and then the human element and its social development. The rest of the book has been a presentation of the various efforts put forth by man to utilize the land and its products, and the results attained by such efforts. Thus have been developed the agricultural industries, the animal industries, the mineral, manufacturing, and transportation industries. And, finally, we have considered the various methods adopted or proposed whereby each and all of our industries have been or may be raised to a higher grade.

Industrial life is only one part of social life. We have undertaken to make a survey of a certain section of the nation's life; that is, of its industrial and commercial development. But it must not be forgotten that this section of the national life cannot be separated from other sections except for purposes of study, for if we wish to see our industrial life in operation, we can never see it thus by itself. There are other sets of national institutions — such as the domestic, the political, and the religious — which exist side by side with the industrial institutions, and which deeply influence them and are deeply influenced by them. In fact, these several sets of institutions do not really exist side by side, but completely interpenetrate one into another, so that they have no independent life of their own, but form one living body and one life, which is the life of the nation.

The need of understanding our national life as a whole. A true industrial education is, therefore, not complete unless its recipient has arrived at some conception of the relationship between the national industrial life and other aspects of the national life. This means that that man has the best industrial education who has not limited himself strictly to the study of industry, but who has

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also read and reflected upon the other aspects of national life and their relations one with another. It is necessary for the purpose of study to take up one section of our national life at a time, and so we have a history of American politics, for example, as well as a history of American industries and commerce. In the present book we have confined ourselves to the latter topic, but we cannot conclude our work without warning the reader once again that industrial life is but part of the national life and cannot be thoroughly understood without a comprehension of that life as a whole. When one has derived a conception of our American industrial and commercial organization from some such series of facts and conclusions as the one we have here presented, he must realize that his conception is still incomplete until it is expanded to take in a vision of the industrial organization in its mutual relations with the rest of the national structure.

QUESTIONS FOR REVIEW

CHAPTER I

PRODUCTIVE AREAS AND PHYSICAL FACTORS AFFECTING PRODUCTION

How is land the basis of all life on earth? What is meant by land-wealth? What is the United States Proper? How large is it? What advantages has the United States in location? Why is the quality of land important? Why can our land support many industries? What is of more importance than excellent quality of land? Why?

What physical factors affect production? What is climate? What factors determine climate? Men living in the temperate zones have what advantages? Why is high altitude equivalent to high latitude? Why are winds factors in man's life? What causes the difference in the temperature of England and Labrador? What is meant by "aspect" of land? How much annual rainfall is desirable for human life? for agriculture?

What is irrigation? How is the cultivation of the soil the basis of civilization? Name the essential plant foods. What three soils are most productive? What are the two basic factors in plant life?

What is the general difference between the eastern and the western parts of the United States? Give the general division of physical areas in the United States for the study of industries. What is the "fall line"? Where is it? What are the industries of the Appalachian Mountains? What is raised in the Central Lowlands? Why is this an agricultural section? Where are the best grazing lands of the United States? Name four mining sections.

CHAPTER II

NATURAL RESOURCES

What are commonly thought of as free gifts of nature? Are these free everywhere? What do you mean by "natural resources"? Why is it necessary to conserve natural resources? What is meant by conservation? The three needs of man are what? How does he supply them? Name some substitutes for wood as fuel. What is needed to utilize resources?

What are the main causes of our success in industry? What did the report of the National Conservation Commission reveal in 1908? What is the position

of the United States in regard to minerals? Where are the coal areas of the United States? How are their locations an advantage to manufacturers? What is the most important nonmetal? the most important metal? Where is iron found? Why is iron important? How large are our petroleum fields? Where are they located? What is the difference between natural gas and "producer" gas? How does the United States rank in extent of natural-gas fields? Name six other important minerals. What is the classification of the forests of the United States? Which contain hard woods? soft woods?

Why is water so necessary? What effect has water power had on settlements? Why is water power resuming much of its former importance? Where is the greatest proportion of our potential water power? What five groups of states are using power other than water power? What is the reason for this?

Why are native plant and animal life more important to the savage than to the civilized man? How important to us are the native products of North America?

CHAPTER III

THE HUMAN ELEMENT

What is the unit of production? What two races have developed a high civilization? What two backward races form a part of our population? What were the labors of the Indian? Why did he not become a part of the white man's civilization? What influence has he had? Why were negroes brought here? What climate is best for the white man? Why? What was the great need of the South? How was this met? Why was the Indian a poor slave? Where is the negro needed in industry? Why?

From what countries did the early immigrants come? What was their character generally? What were some of the causes of immigration? From where did the later immigrants come? What is meant by the "melting pot"? Give two unfavorable features of recent immigration. Why is it so important to educate our immigrants? In what ways is the immigration question an important one?

CHAPTER IV

SOCIAL DEVELOPMENT

Why is the "American type" not a permanent thing? What is frontier society? Why does the society of the North and the South differ so radically? Why are there so few white people in the tropics? What is the reason for classes in tropical society? Why are the tropics important industrially? Why are they economically dependent? politically dependent? What causes the homogeneous population of the temperate zone? Why could the North

have free labor rather than slaves? Are tropical or temperate colonies more independent of the mother-country? Why? Why has Yankee cleverness become proverbial?

What are the three features of democracy? What kind of men were first attracted to North America? How did the life here make for equality? What leads to the political independence of a community? Why have Americans developed such national prosperity? What are the characteristics of the American man? What has helped to form these? What is becoming of our frontier? What effect does social life have on industry?

CHAPTER V

CEREALS

In what way is farming the foundation of all industry? What is agriculture dependent upon for success? What is the principal source of our wealth? Why? Why are we superior to other nations in agriculture? What cereals do we raise? What part has corn played in our agricultural development? Where is the cereal belt of the United States? the "corn belt"? What proportion of the world's corn crop do we raise? For what is corn used? In what form is much of it exported?

What is the difference between "white wheat" and "whole wheat"? Where was wheat grown in the colonies? Explain its decline in Virginia and New England. Where is the "wheat belt"? What factors led to wheat-raising in the West? What proportion of the world's wheat do we produce? What is the average yield per acre in the United States? What industries are connected with corn and wheat? How much of our wheat crop do we need for home consumption?

Where are oats most used as a human food? Where are most of our oats raised? What country yields the most oats? What one ranks second? Where is most of the barley grown? What has supplanted this as a human food? Where is barley raised in the United States? For what is rye used? How important is the crop in the United States? In what section is it found? Where is rice grown in the United States? Why is it in more common use in the East than here? For what is sorghum used? What use has buckwheat?

CHAPTER VI

VEGETABLES AND FRUITS

What is meant by "payment in kind"? How does this illustrate the importance of vegetables and fruits? When were fruits and vegetables first raised for commerce in this country? How are markets supplied with them out of season? How has such food transportation affected our way of living? How

do potatoes rank as a staple food? What can be used as a substitute for potatoes? Where are most of the potatoes raised? What is the average yield per acre? Is this large or small compared with wheat and with area? What are some of the dangers to the crop? How much is it possible to increase the yield in our fields?

What are legumes? nodules? What value have they for the soil? Why is our production of peas and beans small compared with that of other countries? Why are we less careful of sugar beets than the people of Europe?

How does the standard of living affect fruit production? How long has the apple been cultivated? Why were apples used almost exclusively for cider in this country at first? Where were our apple orchards first found? Where now? What is the value of the apple crop compared with other fruits? Where were peaches first cultivated? Where are they found in the United States? In what forms are peaches marketed? What two crops only surpass the grape in value? Where are grapes grown in this country?

From where were oranges introduced into America? In what climate do they grow? Why can you buy oranges at all times of the year? Name some other important fruit crops. What four fruits are now raised here that were formerly imported entirely? What industry is based upon fruits and vegetables? How important is it?

CHAPTER VII

SUGAR

What are the sources from which sugar is obtained? Why has commercial industry not been confined to the merely useful products? How did sugar change from a luxury to a necessity? When is it now a luxury? What are common sources of commercial sugar? How does sugar cane grow? Where? Where does it grow in the United States? What territories of the United States produce sugar cane? Where is its production most successful? Why?

When did beet sugar become an important industry? Where is its most successful cultivation? How did war stimulate the beginning of this industry? When was the industry firmly established in this country? What states produce the most beet sugar? What proportion of the world's production do we raise?

What processes does the cane pass through to become white sugar? What is the vacuum pan? How are beets treated to produce sugar?

CHAPTER VIII

COTTON

What factors are necessary to successful cotton-growing? What hindered the demand for cotton in the eighteenth century? Show how our production of cotton has been increasing. What part of the world's crop do we raise? What

part has cotton played in our history? What was cotton first used for? Who was Eli Whitney? How did he aid the cotton industry? What states lie in the "cotton belt"? Which one produces the most cotton? How long did it take for the cotton industry to recover from the effects of the Civil War? Name the varieties of cotton. Which is the best? Why? Where is it grown?

Describe the cotton plant. Why is the harvesting done by hand? Why is it the costliest part of the production? How is cotton prepared for market? Where is cotton manufactured? Why is New England the chief factory region? Describe the advance made in spinning. How was weaving first done? What is meant by a factory system? Describe mercerizing. What is its value? What are the last processes in cotton manufacture? What are the sources of modern dyes?

What are some of the uses for cottonseed? How is it treated? What are by-products? What cities are called the cotton cities? Why?

CHAPTER IX

CATTLE

Why were wild animals of little value to man? How did the domestication of animals advance the civilization of man? Why did man care for the breeding of animals? Explain how a country's wealth lies largely in domesticated animals. What is necessary to keep up a good breed? Why did the savage fail in this? Why are there few American breeds?

What different kinds of cattle were brought to America? For what were they used? Why were the early cattle poor grade? What influence did the East exert on Western cattle-raising? What were the cattle states of 1850? What are they to-day? Why do cowboys and farmers dislike each other? Why are there few milch cows on the Plains? What effect has the refrigerator car had on the cattle industry?

How was fresh beef sent across the Atlantic? Why is more live stock shipped to Europe than fresh beef? Which is more expensive? Where are the meat-packing centers? What started this industry?

How is milk brought to large cities? Why are sanitary methods emphasized for dairies? Describe a modern dairy. Explain the growth of the cheese and butter industry. Where are the centers of the dairy industry?

CHAPTER X

SWINE AND SHEEP

Where were hogs found in colonial days? How did their quality compare with that of to-day? Where is pork eaten? Name some of the best breeds of swine. How were they developed? Why was swine production closely related

to slavery? What is meant by "corn on the hoof"? Why is it valuable? What cities are associated with pork-packing? Why is the corn belt identical with the swine belt? Where is it?

What is the difference between a lard hog and a bacon hog? Where is each found? Where are the most hogs raised? How much of the hog is used in the packing plant? What are some of the uses? the by-products? In what forms is the meat prepared for market?

What three uses had sheep in ancient times? Who brought the first domestic sheep to America? Where was colonial sheep-raising most profitable? Why? What sheep give the best wool? What was the Ancon breed? What are the superior points of the merino? Why are there not more merinos in this country? For what is the karakul sheep valued? Explain the gradual rise in importance of the mutton breeds. What value had a "fat-tailed sheep"? Where are the greatest numbers of mutton breeds? In how many states are sheep found? Where are the greatest numbers now?

What two countries surpass ours in numbers of sheep? How important is rainfall to sheep-raising? How many classes of wool are there? How often are sheep sheared? What success has the breeder had in increasing the weight of a fleece? How much wool do we import?

CHAPTER XI

HORSES AND MULES

By what different nations were horses first introduced into the United States? What is the origin of the typical American horse? When was the stock greatly improved? What is the best breed of farm horse? of draft horse? What was one of the reasons for road improvements? How did the horse-car system raise and then lower the demand for cheap horses? What kept up the demand for horses in the country? Where are the horse-raising districts? What other value has the horse than for transportation?

What is a mule? Where is the mule used mostly? How does it compare with a horse? Where is the mule particularly adapted for labor? How many mules are in this country? What is their value?

CHAPTER XII

FISHERIES

What influence has fishing had on our history? Why did Massachusetts become a center of this industry? What town in particular was and still is devoted to it? Where are the two great fishing grounds of the world? Why

did New England hold a monopoly of the fishing trade for so long? What other industries grew out of this supremacy? How does fishing aid in developing other maritime interests, merchant marine, etc.? What two well-known books were written about this fishing life?

What are fishing rights? What besides food is derived from the fisheries? How important are our fisheries? Trace the beginnings of the whaling industry. What places are associated with this industry? What factors led to a decline in whaling? What states have led in the cod-fishing industry? Why is cod-fishing yielding to inshore fishing?

What was the first use for mackerel? When were mackerel first salted? What effect did this have on the industry? What state is the center of the industry? Name six other important fisheries of New England. How has the use of ice changed the character of fishing?

How long did New England remain supreme in the fishing industry? What other sections are now in the market? What kinds of fish do these supply? What are the products of the Gulf fisheries? What state leads? What fish are found on the Pacific coast? What kind is most prominent commercially? Where is the great fur-seal breeding ground? What interest has the government in it? Where are oysters found? What per cent of the world's supply do we furnish? What are some of the duties of the United States Bureau of Fisheries? How important are our fisheries?

CHAPTER XIII

COAL AND PETROLEUM

What are some of the differences between minerals and the plant and animal products? What conditions are necessary to the successful operation of a mine? How are minerals classified? Name some belonging to each class. Which has the greatest value in our annual output? Why is mining a primary rather than a secondary industry?

What is coal? Describe the different kinds. Where is each mined? When did coal come into common use in this country? What was the first extensive use of coal in industry? How did the railways develop the bituminous-coal industry? How is coke prepared? Where is its greatest use? What proportion of our supply remains to be mined? How much coal is consumed per capita? What are some of the ways in which coal is wasted? Why is coal indispensable now? Why is economy in the use of coal necessary?

How long has petroleum been known? In what places was it in early use? For what purpose was Seneca oil used? By whom was petroleum regarded as a nuisance, and why? What was the first oil company? Where did it operate? When did the real oil era begin?

CHAPTER XIV

IRON

About how long has iron been known? What mineral alone surpasses it in abundance? When was it used in America first? Describe smelting. What is the difference between wrought iron and cast iron? What were the first iron beds to be worked in this country? Why was the industry small up to 1800? Describe the growth in production to 1860. What factors made Pennsylvania a great iron-producing state? How did the use of bituminous coal change this?

Where are the great iron-mining regions of the United States? What corporation owns a large proportion of them? Why is this a great iron age? What is our present production of pig iron? its value? its relation to the world's production? What factors have enabled the United States to surpass all countries in the iron industry? How did the Great War show the value of iron?

CHAPTER XV

GOLD AND SILVER

Where is gold found? In what forms? What two qualities does it possess that have made it a favorite metal? Why is gold not used more freely for coins? What metals take its place for these? What was the "Silver Fleet"? What would a great increase in the production of gold lead to? Why?

Describe the processes of obtaining gold. How has our gold industry developed? What states lead in production?

Why did silver have such a high value? Where was it known in America? What was the state of early colonial silver-mining? When was the largest deposit in the world found? Where? What is the story of the Comstock Lode? What states lead in the production of silver? How may silver illustrate the power of national resources over national affairs? How is silver a by-product? For what is silver largely used?

CHAPTER XVI

OTHER MINERALS

Name ten of the lesser minerals. What metal is second only to iron? Where is it used mostly? What forms bronze? brass? How did the Indians mine and use copper? In what Eastern states was copper found? What three states enable us to lead the world in copper production?

In what forms is lead found? In what states is it extensively mined? Why is the zinc industry comparatively new? What state produces the most zinc?

What are the valuable properties of aluminum? What is aiding its greater production? What are some of its important uses?

How was clay first used? How important is the industry now? With what industry is it closely connected? What are the principal stones quarried? What are the three types of cement? For what are they used? In what minerals are we deficient?

CHAPTER XVII

ADVANTAGES OF THE UNITED STATES FOR MANUFACTURING, AND THE LOCALIZATION OF INDUSTRIES

What is meant by manufacture? Give examples. When did the great manufacturing period of our country begin? What are some of the causes for increased manufacture? Name the five leading manufacturing states. What are our four great classes of manufactured goods? How large a value do they represent? In what resources are we rich? What part has water transportation played in our development? What is the greatest internal waterway in the world?

What is meant by freedom of trade in the United States? What developed the tendency to seek out the best and quickest ways in commercial industry? What is meant by mobility of labor? How has this influenced American production? Why can American labor be independent? What influence has our form of government had on our industrial success?

What seven factors determine where an industry shall locate? What five states produce a large proportion of our manufactures? What is one reason for this? What advantages did New England have for manufacturing? How does climate influence labor efficiency? Why must manufacturing plants be located in thickly settled regions? Why do we have specialization of industries in different sections of the United States? How does New Bedford illustrate the change in source of capital for our industries? What cities owe their success to an early start in their particular industries? Name the respective industry in several of our states.

CHAPTER XVIII

FOOD AND KINDRED PRODUCTS

What is the most important group in the American industries? Into what two divisions is it separated? What is the most important product in the animal-products group? How were pork products marketed from the West? What city leads in this industry? What effect has competition had on this industry?

Why is flour manufacture the most important of the vegetable-products group? Describe the process of milling. Where were the milling centers before the Revolution? in the early nineteenth century? Why has the center moved westward? What caused the decline of St. Louis as a shipping port for flour? Describe the growth of Minneapolis as a flour city. Describe the improved process of milling. How important is flour as an export? How valuable is the industry of our flour and grist mills?

What are some of the other industries dependent upon vegetable materials? In what ways have we wasted food?

CHAPTER XIX

METALLIC PRODUCTS

Why can the use of metals be taken as an index of a people's civilization? What state and city lead in iron manufacture? What factors gave England the supremacy for a long time? What did Sir Henry Bessemer do for this industry? What is the work of a foundry? a rolling-mill?

Name some of the special products of the foundry. In what cities are tools made? cutlery? For what is New England prominent in this industry? How have mechanical devices affected this industry? What is meant by standardization of parts?

Where were our first railroad engines made? What kind of engines were built in this country? Where were the plants usually located? When were locomotives first built in the United States? Where?

In what states were silverware and jewelry manufactured at first? How important is the metal manufacture of the United States?

CHAPTER XX

TEXTILES

What three things are included under textile industries? What are the four leading materials manufactured in this country? What cloth was made in colonial days? How much? Trace the development of the linen industry in the United States. Why was there so little early woolen manufacturing? What factors hindered its development later? How great an industry do we have to-day? Where is the greatest amount of woolen manufacturing?

What hindered the construction of textile manufacturing machinery in the United States? Where were the first cotton factories? In what section of the country did the factory system develop? Describe the growth of cotton manufacturing up to the Civil War. How has this industry recently developed in

the South? What advantages for this industry does the South have? New England? What are the five leading states for cotton manufacture?

Where were the first attempts at silk-raising in this country? Why was it generally unsuccessful? Why were Americans more successful in silk manufacturing? What branch of silk manufacture was most in demand? How much has this industry grown since the Civil War? What is rayon? What other fiber is manufactured here? For what is it used?

CHAPTER XXI

LUMBER AND PAPER

Why are great forest areas an advantage to a country? How do we rank in forest resources? Why was the invention of the sawmill so important to the colonist? What business grew out of land development? How did the steam sawmill change the character of lumbering? In what sections has large-scale production been developed? What caused a shifting of the location of this industry? What are our leading woods? How important is the industry?

What is a planing mill? Describe the development of the furniture industry. What woods have been popular for furniture? What are some articles of American origin? What cities are the largest manufacturers of furniture? What states lead in value of production?

About how long has paper-making been known? Why was its use so restricted? From what materials has paper been made? Where were the early paper factories in the colonies? What effect has machinery had upon paper-making? Describe the process of preparing wood pulp. Where are the greatest paper-manufacturing districts in the United States? What factors led to this? What city is the center for paper-making from textiles? Where does this country rank as a producer of paper? Trace the development of the wall-paper industry. What are some of the modern uses of paper?

CHAPTER XXII

LEATHER AND RUBBER

How did the Indian women tan leather? In what ways did Massachusetts regulate the tanning industry in colonial days? Describe tanning. For what are heavy hides used? calfskins? sheepskins? goatskins? dogskins? pigskins? horsehides? What are some of the other skins used?

What is the greatest use of leather? Describe the method of colonial shoemaking. Why do we import so many hides? What is the history of Lynn

shoemaking? What has influenced the improvements in American shoes? What are some of the machines used? What Massachusetts cities manufacture shoes? Name five other centers of this industry. Where is the main market?

How valuable is the saddle- and harness-making industry? Where are most of our gloves manufactured? What is the present condition of the leather trade?

Where is rubber found? What was its first use? How is rubber vulcanized? What is the process called? What effect did the discovery of this process have on the industry? Where are our rubber factories? What have been some of the factors in raising the demand for rubber? What is vulcanite? For what is it used? What is the leading branch of the rubber industry? Which state leads in the manufacture of rubber footwear? Name some of the important articles made from rubber. What is artificial rubber called? What use is made of old rubber?

CHAPTER XXIII

CHEMICALS AND DYESTUFFS

What part does chemistry play in the commercial world? Where did the manufacturing of chemicals start in this country? What was the first product? What reason is assigned for the slow development of the industry? What effect has the Great War had on this?

For what is sodium bicarbonate used? How is much of it obtained? What are the three essential plant foods? Where is phosphorus obtained? What was the earliest form of fertilizing? Why has the manufacture of fertilizers become so important? Where has potash been found in our country? When was the manufacture of potash salts started in the United States? What is its importance?

From what is nitrogen obtained? What are the future prospects of chemically produced fertilizers? Of what value is electricity in chemical industries? How are soaps and oils made? What is obtained from coal tar?

What was the source of the earliest dye known? What is a natural dyestuff? When were aniline dyes discovered? What stimulated the coal-tar industry in America? With what result? Where is the bulk of our artificial dyes obtained at present?

CHAPTER XXIV

ELECTRICAL MACHINERY AND APPARATUS

When was the electrical industry first reported as a separate industry? What has been its growth since that time? What is the use of dynamos? What two types are there? When did the electric motor begin to play an important part in industry? What are some of the uses of the motor? Where are storage batteries extensively used? How have they increased in value?

What is the difference between an arc lamp and an incandescent lamp? Which is increasing in use? How much has the manufacture of telephone apparatus increased since 1900? What was one of the causes of this increase? What are some of the electric heating devices? What relation is there between water power and electric power? What is the annual value of radio apparatus produced? What six states supply most of our electrical apparatus?

CHAPTER XXV

BEGINNINGS OF THE AMERICAN TRANSPORTATION SYSTEM

Why does distribution become so important in our industrial development? What were the beginnings of trade? What effect has rapid transportation had on our national resources? How was most of the Indian transportation carried on? What was the reason for this? What types of canoes did the Indians have? What have many of the Indian trails developed into? Why have important railroads followed Indian trails? What was the Indian "travois"?

Why were the early settlements in this country on waterways? What effect did the Appalachian Mountains have on settlement? What factors retarded the building of intercolonial roads? What was the condition of roads at the time of the Revolution? How was most traveling done?

Describe the early postal service. What led to the establishment of ferries? of bridges? Who generally owned them? What states owned most of the colonial tonnage? What types of boats were used on the seacoast? on inland waters? What was the common history of a river flatboat? When did the steamboat become the general carrier on all waters?

CHAPTER XXVI

TURNPIKES AND CANALS

Why were private citizens interested in ways of transportation? Where was the first turnpike? Who were the stockholders in such turnpikes? What authority had the state over them? In what section of the country were most of the turnpikes built? Were they profitable investments? Why? What part did roads and bridges play in the high cost of transportation?

What did Gallatin's report show about the cost and number of roads in this country? What were some of the projects he advocated? Which of these projects have since been carried out? Where was the Cumberland Road? Of what importance was it? Why was the Wilderness Road important? What effect has the automobile had on roads?

When was the great period of canal-building? What class of people were especially interested in easier communication with the West? When was the

Erie Canal completed? What gave New York such an advantage over Pennsylvania in the matter of a route to the West? What did the states hope to get from canals? What causes led to their failure? Why has the Erie Canal proved successful? How is it now used? What is the history of the Panama Canal?

Why is the use of canals being urged again? How will their use aid in conservation? When did the states begin to withdraw from actively aiding transportation projects? Why?

CHAPTER XXVII

RAILROADS

Where were the first attempts at railroad construction? Who built the first successful locomotive engine? What was the first railroad in the United States? Describe its cars. Name some of the other early lines. What stood in the way of railroad systems? Why were engineering difficulties so much greater here than in England? Describe the early locomotives. What retarded the growth of railroads?

What city was the first railroad center? What were the first lines reaching toward the West? What are trunk lines? Upon what were they constructed? What two roads joined to make the first transcontinental line? What part did the railroads have in the panic of 1873? In what sections of the country was the greatest amount of construction after 1873? What is the present relation between mileage and traffic? What proportion of the world's mileage is in our country?

How do the present railroad rates compare with the early rates? Upon what does a railroad depend for its revenue? What are the advantages of electric railways? How has the railroad aided American industry?

CHAPTER XXVIII

NATURAL WATERWAYS AND THE MERCHANT MARINE

In what ways are natural waterways important in the development of industry? Why do we lack statistics on the traffic on natural waterways? What are the two great natural systems in America? To whom have they been of great use? What hindered traffic on the Mississippi? What two events greatly influenced river navigation? What were the requirements of a successful river steamboat? What has been the relation between steamboat traffic and the railroads? What effect did the Civil War have on this competition?

Give two important features of traffic on the lower Mississippi. What does the Great Lakes System include? What is its one great drawback? What

have the Canadian and American governments done to improve this system? Of what does most of the Lake traffic consist? Name two important Lake cities. Why is the freight rate so much less than on the railroads? How extensive are our inland waterways? What is the ideal system?

What is the merchant marine? Why were the colonists so interested in shipping? What trade did they have with the West Indies? What training did the early merchant seamen need? What type of ship did they evolve? In what three branches was our merchant fleet engaged in the eighteenth century? What led to our becoming the carrying nation of the world?

What caused the development of the clipper ship? Why were our sailing vessels in such demand? What were some of the causes of the decline in ships? What is the present state of our shipping? Why has n't the steamer entirely superseded the sailing ship?

Why were we slower than England in changing to steel ships? How do terminals limit the size of our ships? In what way does coastwise shipping differ from foreign shipping? What has figured largely in its development? What are the probabilities of a large merchant marine?

CHAPTER XXIX

THE INFLUENCE OF TRANSPORTATION UPON AMERICAN INDUSTRIAL DEVELOPMENT

How are trade and transportation each dependent upon the other? In what way has the trader spread civilization? How has transportation been the keynote of our industrial success? How has our territorial division of labor been made possible by transportation? Why have railroads increased property values in this country so much more than in England?

How do city land values depend upon transportation? What political value have good transportation facilities? Show how good transportation means a lowering of prices. What did contemporary men think of cheaper transportation? How do twentieth-century rates and nineteenth-century rates compare? What has made low rates possible? What effect did the Erie Canal have on transportation rates? What factors have aided in the improvement of communication?

CHAPTER XXX

INTERNATIONAL COMPETITION FOR INDUSTRIAL AND COMMERCIAL SUPREMACY

By what means may industry be stimulated? Where was the first great struggle for trade supremacy? In what field was the rivalry of Portugal and Spain? Where did England stand in the struggle for the world's markets?

What advantages has England had for supremacy? What two nations are her competitors? Name the five leading commercial countries. What changes has this century brought about in commercial and industrial methods?

How will science applied to industry help to eliminate failure? What is the method that science uses? What is meant by "margin of superiority"? How is it figured out? How will scientific management benefit industry? By what means does the English government aid the English business man? How does the German method differ from the English? Why were we so late in developing interest in foreign commerce? How has our consular service been reformed? Of what aid are business men's organizations? What is the National Chamber of Commerce? its duties? Why is efficiency so necessary?

CHAPTER XXXI

MARKETING

Why has production always been the first step in industry? Why were there no problems of marketing in colonial days? What is the distinction between a fair and a market? How was the county fair a forerunner of the market? What is the weekly market? What was the position of the local store in commerce?

Why has the modern market become necessary? Why is the marketing of farm products of prime importance? Why are middlemen necessary? How does purchasing power vary in our country and affect marketing? Name several distributing agencies. Explain the three stages of marketing. What products cannot be sold by description?

What is the function of a middleman? Why does export trade demand greater attention than domestic trade? Explain the difference between direct and indirect trade. What is the duty of a branch corporation? What are the duties of a forwarding agent? the advantages? Why is it so necessary to know the tastes of foreign consumers?

CHAPTER XXXII

THE FINANCING OF INDUSTRY AND THE DEVELOPMENT OF CORPORATIONS

Why is capital so important to industry? What capital did the American colonists have? Why was little money invested in manufacturing by the colonists? How did this situation change in the seventeenth and eighteenth centuries? In what type of enterprise did the colonists usually invest?

What was the beginning of the small corporations of New England? How did the government aid in developing manufactures? Where did the capital come from that aided our industrial development?

How did corporations develop? What are their characteristics? What factors have aided their growth? What part is the corporation taking in our business life? How has the character of industry changed since the Civil War? Why was combination necessary? How was competition wasteful? Why is large-scale production more economical?

What are four advantages of corporation? Why are these not found in the individual system? What are some disadvantages?

CHAPTER XXXIII

LABOR ADJUSTMENTS

How has labor influenced the progress of civilization? How was scarcity of labor first overcome in the American colonies? What was the character of the first servants? How has immigration developed manufacture? Why did most laborers prefer agriculture? What hope did American industry hold out to skilled labor? From what countries did many of these men come?

What were some of the improvements brought into use by skilled workmen? Where was unskilled labor in demand? What opportunity has the immigrant in this country? What has he done for the country? What wages did the unskilled workman receive in the last century?

What caused the first labor movement? When did the trade-union movement develop? What has tended to separate labor and capital? What did the early labor legislation have in view? What brought the labor unions to public attention? When did this occur? In what ways have labor conditions improved in late years? Why are capital and labor interdependent?

What is meant by employers' liability? Why should accidents to workmen be classed as a social problem? What three defenses enabled an employer to escape liability for accidents? What principle is behind the workmen's compensation laws?

What protection does the employer have against the expenses of accident claims? What is group life insurance? What effect has it had on the relation between employer and employee? What effect has it had on production?

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